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UROLITHIASIS IN DOGS AND CATS

By

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While other members in the adjacent hall were discussing the physiology of reproduction in the dog, a considerable number selected for their attendance, this session at the Bishop Partridge Hall, Church House, Westminster, on the afternoon of Friday, August 12th, 1949, at which was discussed the (circulated) paper presented by Dr. AGNETE KRABBE, of Copenhagen, with Mr. T. L. Wright, M.R.C.V.S., of Putney, in the chair.

The CHAIRMAN expressed regret that, owing to the overrunning of the previous session, they were starting rather late. Very little time was left for discussion, so that he would be very brief in introducing the speakers.

Capt. Wright continued: I would remind you that all visitors are welcome here, and will receive a welcome at our annual general meeting. They received a welcome at the opening of the previous meeting here, and I would just like to repeat that if any newcomers wish to visit us from outside our Association we shall be very pleased if they join in the discussion at the end.

I have much pleasure in introducing the lady presenting the paper on Urolithiasis in Dogs and Cats. From 1941 to 1945 Dr. Krabbe was assistant veterinary surgeon at the small-animal clinic of the Royal Veterinary and Agricultural College in Copenhagen, and since 1945 has been Professor. You will, therefore, realise that she has had very considerable concentrated experience in the handling of small animals and in this particular subject.

Dr. AGNETE KRABBE then made the following prefatory remarks: In most countries, urolithiasis is a rather common and well-known disease in small animals. As a rule, diagnosis is easily made, but there may be difficulties in detecting renal calculi, and especially ureteral calculi, because the pains, which are often not to be judged objectively, may be the main symptom present.

As to urethral calculi, there is no question about choice in treatment, because the stone (or stones) has to be removed as soon as possible and, if there is complete stoppage of the urine, immediately. In most cases this can only be done surgically, and if the concretion is situated at the usual place the incision is made just over the hind part of the penial bone.

If we know that small stones are present in the bladder at the same time, or there has already been a recurrence, we often create a permanent fistula at the upper part of the urethra above the edge of the pelvis, also if many calculi are heaped up in the urethra and it is impossible to remove them.

The mucous membrane is connected with the skin by silk sutures and the opening is dilated every day for the first week with increasing sizes of metal catheters. Great care must be taken during this procedure to avoid bladder infection—if such is not already present. The animal retains control of the flow of urine.

A few small and smooth bladder stones may give only very slight or maybe no symptoms.

If the animal seems to have no pain or trouble and the growth of the concretions is very slow, decision as to whether an operation is to be performed or not must depend upon the age and health of the animal.

On the other hand, there is always a risk of severe, maybe ascending infection, which may be dangerous—and in the male animal small concretions may slide into the urethra and lodge there at any time.

If you leave the animal without treatment the bladder concretions may reach a considerable size. In the collection of the pathological anatomical department (at the Veterinary Agricultural College in Copenhagen) we have some old specimens (from the beginning of the nineteenth century) from animals which died of urinary troubles, and you could get both of your hands full of stones from one of them—or a single stone bigger than a goose egg.

We perform cystotomy under nembutal narcosis and the incision is made in the middle line—through the linea albo—just anterior to the pelvis. As most of the dogs suffering from cystolithiasis are bitches, this incision is easily made: in males we merely push the preputium and penis a little to one side. The dorsal part of the bladder is incised and the calculus (or calculi) removed. In the event of many small concretions being present, we use the silver spoon also—and if your fingers are not too large it will be wise to run through the whole bladder cavity, especially the neck of the organ, to make sure that nothing is left.

Previously we used catgut for suturing, but it seems as if very close Lembert silk sutures through peritoneal and muscle layers are more secure. Having completed the operation, we put on the bladder suture line a little powder consisting of sterilised sulphathiazole with penicillin 1,000 I.U. per gramme.

If urinary infection is present, primarily or secondarily, we irrigate the bladder with a body-heat solution of silver nitrate 0.3 per cent., including pantocaine nitrate 0.1 per cent., before the operation. Sulphathiazole is given as 0.15 grammes per kilo, divided into three doses, both before and after the operation. If there is a danger of peritonitis, we also employ penicillin 3,500 units per kilo per day, with adrenaline, divided into two injections ; for a short period we also administer penicillin procaine for larger dogs.

In my paper I mention that in human medicine permanent irrigation with an acid solution has been used with

good results in the treatment of infection-produced stones in man, but that this method cannot be practised in small animals on account of its long duration.

Last summer some surgeons from the Mount Sinai Hospital in New York published investigations on the disintegration of eight bladder stones, which had been surgically removed, by means of an enzyme known as hyaluronidase. After a few hours in a solution of this enzyme the concretions resolve completely into sediment. The explanation is that the inorganic salts are cemented together by an organic matrix—the so-called protective colloids—which should consist mainly of hyaluronic acid. By treating with the corresponding enzyme this stroma is dissolved and the stone will disintegrate.

I have been able to try this only on four concretions just removed from dogs, but I am sorry to say I did not succeed in making any change in the stone; but maybe I have done something wrong.

Finally, I would just like to mention a matter which is quite interesting. At the chemical laboratory in our institute Dr. Petersen observed that ca-oxalate in urine usually sediments in the more soluble form of dihydrate, whereas in water it falls out as monohydrate which is less soluble. In urinary stones the more recent outer layers usually consist of dihydrate, while the deeper portions become transformed into monohydrate. The cause or reason for this has not been found so far.

The CHAIRMAN thanked Dr. Krabbe for her Address in introducing her paper, which was as follows:—

Urolithiasis in Dogs and Cats *

From 1934 to the present time, *i.e.*, during the last fifteen years—11,291 dogs and 1,024 cats have been treated at the small-animal clinic of the Royal Veterinary and Agricultural College in Copenhagen. Seventy-two of these dogs were diagnosed as suffering from urolithiasis, *i.e.*, about 0.6 per cent.

Calculi may be found in any part of the urinary system, but we cannot say where they are formed originally, as often they move from one place to another with the urine. Nevertheless, we speak of kidney stones, ureteral stones, bladder stones, and urethral stones—referring to the position occupied at the time of discovery—because it is convenient thus to gather under one heading concretions which—due to their site— produce almost the same symptoms. Following this procedure we found that urinary calculi were most commonly diagnosed in the urethra masculina (namely, in 41 of the 72 dogs) though we realise that many of these animals were carrying stones in the bladder or the kidney as well.

The diagnosis cystolithiasis has been made in 30 cases (out of 72) and the concretions here are often found in one specimen or a few larger ones may be found. In addition to urethrolithiasis or cystolithiasis, nephrolithiasis was ascertained in nine dogs—in one dog this was the only concretion found.

We have observed only two cases of ureteral calculi. One terminated fatally because both ureters were obstructed, and the dog died within a few hours after being brought to the clinic. In the other case, also, the ureteral calculi were revealed by autopsy. This case will be mentioned later.

* Presented to the Sixty-Seventh Annual General Meeting and Congress of the National Veterinary Medical Association, in London, August 12th, 1949.

URETHROLITHIASIS:

We have found urethrolithiasis only in males, which is quite natural because the urethra feminina is straight and wide, so that stones have to be rather large to be unable to pass. Yet obstruction of the urethra feminina by a big stone (1 cm. in diameter) was found on *post-mortem* examination in a bitch, which died shortly after being brought to the clinic.

In our material many different kinds of breeds—both big and small—are represented, and the disease occurs at any age from a few months to 13 years.

A calculus moving from the bladder into the urethra may be so large that it cannot pass the edge of the pelvis; generally, however, it will be held up just behind the os penis (or at the caudal part of this bone). Others may follow and heap up behind it—like pearls on a string.

The symptoms depend upon the size and position of the stone (or stones), varying from slight trouble in urination to great pain or complete stoppage. The urine passed is often mixed with blood. A catheter cannot reach the bladder, which may be distended to such a degree that there is danger of rupture. If nothing is done the dog will die from uræmia. There is little possibility of making the stone pass by means of instillation of oil with some local anæsthetic in the urethra, and in most cases it will be necessary to operate immediately. To prevent the accummulation of further calculi after removal of those present, it is often advisable at the same time to create a permanent fistula at the upper part of the urethra, where it is still wide and supple—the more so because the operation might cause stricture even if the wound is not sutured.

There is a special reason for making a urethral fistula when the bladder stones found are very small and difficult to remove by cystotomia. Of 41 animals in which urethral calculi had been diagnosed, five were not operated on. In two cases—quite young dogs—we succeeded in removing the concretion without surgical treatment. Three other dogs were not treated, two died and one was killed.

Urethrotomia has been performed on thirty-six dogs. Six of them died in direct connection with the operation (uræmia, cystitis, urethritis, cardiac insufficiency—only two of the deaths seemed to be caused by the operation—due to severe infection in the surroundings of the wound); two dogs died of uræmia after repeated operations; one was killed because it proved impossible to loosen the stone; two other dogs died later on—from complications. As regards the remaining twenty-five patients discharged after one (18) or more (7) operations, it has not always been possible to follow them up to the present time—or till their death (some of them were old dogs)—so we cannot say how many of them remained healthy.

What we especially wanted to know was the fate of the dogs in which a permanent urethral fistula had been made. This operation has been performed in eleven cases, but two dogs died of pyelitis purulenta and cystitis with uræmia; two were killed, one after a few months and one after two years. As far as I know, the remaining seven dogs are—or had been—doing well (some of them have died from old age) and only one owner has claimed to have trouble in keeping the dog clean. We have to admit, however, that there is a certain disposition to epididymitis and orchitis (two cases).

CYSTOLITHIASIS:

As a contrast to the urethral stones, a single bladder stone is more frequently found in the bitch than in the male

dog; 26 of 30 dogs with vesical calculi were females. More than half of them had only one stone, four had two stones, and only five of the bitches had several stones in the bladder, but then more than 300 calculi—weighing 50 grammes—were found on *post-mortem* examination in one of the dogs.

The average age of the dogs suffering from cystolithiasis is remarkably low—4½ years—the more so because the formation of many of the stones—to judge by their size—must have started much earlier. It is remarkable again, that all the thirty dogs in which we made a diagnosis of cystolithiasis were small dogs—half of them small terriers (wirehaired, Sealyham, Scottish), nine were pekingese, three cocker spaniels, one pomeranian. In our material these and other small dogs number only about one-third of the dogs treated at the clinic.

As a rule the presence of a calculus in the bladder will cause some irritation and lesion of the mucous membrane, especially if the surface of the stone is very rough. Hæmaturia is often the symptom that attracts attention (besides frequent urination) but some concretions appear to have reached a considerable size without giving rise to any trouble at all.

If the bladder contains several calculi at a time, these will turn quite smooth, being rubbed against each other. In the bitch badder stones are easily detected by catheterisation with a metal catheter, unless they are very small. In the male dog the diagnosis can be made by palpating the bladder through the abdominal wall or by X-ray examination.

Twenty-four dogs were operated on, five of which died from uræmia in connection with pyelonephritis, cystitis and urethritis. In two cases only was death caused by loosening of a suture in the bladder wall. One died from gastritis ulcerosa and one dog was killed on account of uræmia. There seems to be little danger in surgical treatment, if the urinary infection or the alterations of the bladder wall are not too severe. In a male cocker spaniel concretions have recurred. The first time there was a single stone, on the next occasion there were several calculi and the dog was operated on once more. In December 1948 the dog was brought to the clinic for examination. The bladder was now full of stones, like a bag full of marbles.

I have asked as many owners as possible, if there has been any trouble since the operation, and it seems as if most of the dogs are quite well. One of them—another male cocker spaniel—was operated on ten years ago and is still going strong, now fourteen years old. However, one dog had been killed three weeks after returning to its home, but it was not brought to the clinic, so we cannot say what was wrong with it.

NEPHROLITHIASIS:

Nephrolithiasis has been found in nine dogs, but in six of these not until the *post-mortem* examination. In two cases a diagnosis of cystolithiasis had been made, but the dogs died without being operated on, from pyelonephritis and cystitis. Six of the dogs had suffered from urethrolithiasis, and one of them had been operated on three times. In this dog, in addition to kidney stones, calculi were found in the left ureter and also in the bladder. In three other dogs, the bladder, too, contained stones.

As a rule the presence of a stone—at least a big one—will cause great alterations of the renal pelvis. Pyelitis and pyelonephritis are rather common (five of the dogs), and in two cases pronounced atrophy of the kidney could be seen.

In man, fracture and spontaneous dissolution or removal of pelvic calculi has been described and it seems as if the same thing might happen to kidney stones in dogs, because we have found a dilatation of the pelvis, which could only be explained by the former presence of a calculus. (The dog was brought to the clinic because several calculi had passed with the urine, but nothing was found by examination of the urinary system, and the dog was sent home. Three years later the dog died, and the owner brought it to the pathological-anatomical department for autopsy. Both kidneys were very small; the left pelvis was dilated and contained a stone of about 25 by 12 mm., shaped like the pelvis. In the right pelvis no stone was found, but the same dilatation.)

The symptoms will be difficult to distinguish from those caused by vesical (or urethral) calculi and infection, which—as we saw—are often present at the same time.

The diagnosis could be made only by X-ray examination and so far we have not carried out any treatment.

PROGNOSIS:

Generally we may say that a single bladder stone—if urinary infection is not too advanced—is most often easily removed and the prospects of recurrence are slight. On the other hand, several, perhaps small, concretions in the urinary system are often difficult to treat surgically and there may be a considerable tendency to recurrence. To prevent re-formation of urinary calculi we must know the *cause* of the stone formation.

First, we will look at the possibilities of formation and composition of concretions in general.

If a calculus is to develop in the urine, this must be supersaturated with one or more salts. In man, the normal urine possesses these qualities in respect of calcium oxalate, calcium phosphate and uric acid, but the supersaturation generally is so moderate that no sedimentation takes place during the relatively short stay in the urinary tract. If such sedimentation is to occur the concentration of these substances must rise enormously or their solubility must be reduced—for instance, by change of the reaction of the urine—or both factors must operate. An increase in the salt content of the urine may occur under various pathological conditions of the organism: intoxications, disturbances of the metabolism, local or universal decomposition of tissues or excessive supplies with the food—besides drying with consequent reduced diuresis and finally stagnation of the urine.

Normal urine is slightly acid or neutral, the *p*H varying between 5 and 7. If the reaction of the urine is changed in the acid direction, the degree of saturation of uric acid will increase; if the urine turns alkaline the tendency to precipitation of calcium phosphate, magnesium ammonium phosphate—and, with *p*H over 8, calcium carbonate—will increase. Certainly supersaturation is absolutely necessary to the commencement of a concretion in the urine and its growth, but supersaturation alone is not enough. A stone nucleus must be formed, and in infected urine this might consist of microbes, epithelial cells and other types of foreign body. In non-infected urine the formation of the nucleus probably will take place in this way: Under intense sedimentation cell-like, colloidal drops—the so-called "micells"—will precipitate, gradually acquiring a radiating structure and crystal-like shape. Around these the deposition then starts (HAMMARSTEN).

Contrary to what was formerly supposed, the "protective colloids" of the urine proved not to protect against sedimentation by increasing the solubility of the urinary salts,

but they might reduce the chances of germination. By cementing the inorganic components of urine together, the colloids form an organic matrix, which protects the stone from disintegration and dissolution—even if, otherwise, conditions are favourable to such processes. Finally, to produce the real stone formation the nucleus must be retained in the urinary tract, *i.e.*, stagnation of the urine is necessary also.

Generally we distinguish between two categories of calculi, namely, those which have formed in apparently "normal," non-infected urine—the "primary"—and those which have occurred in infected urine—the "secondary." Calcium oxalate, uric acid, cystine and pure phosphate stones belong to the first-mentioned category, while stones in infected urine are always mixed and consist of magnesium ammonium phosphate, calcium phosphate and perhaps calcium carbonate or ammonium urate. In human medicine it has been stated that the following substances may be found:

1. Calcium oxalate monohydrate (whewelite) and dihydrate (weddelite).
2. Magnesium ammonium phosphate hexahydrate (struvite). These are often accompanied by colloidal apatite.
3. Uric acid (and sodium acid urate).
4. Cystine.
5. Tricalcium phosphate (whitlockite).
6. Calcium hydrogen phosphate dihydrate (brushite).
7. Colloidal apatite pure.

It seems, however, as if there is some variation from one country to another in the main types found. Thus Tovborg Jensen, in Denmark, has found more alkaline infection stones (struvite, apatite, calcium carbonate), and calcium oxalate stones than Hammarsten in Sweden, but not so many uric acid stones. The tendency to oxalate stone formation, on the other hand, both in Sweden and in Denmark, proved to be much higher than in Finland, whose relative freedom was supposed to be due to the larger consumption of milk products. In the U.S.A., Prein and Frondel had a rather high percentage of cystine while not a single stone of that sort had been found by Tovborg Jensen in a considerable amount of Danish material. As to the position in dogs, we do not really know if such variations are common also in them, because, as far as I know, no such investigations have been made on a fairly large amount of material from dogs, except in Holland. In 1935, Langer, of Utrecht, analysed chemically 28 calculi over the last ten years and found:

	No. of cases
1. Triple phosphate (magnesium ammonium phosphate	18
2. Calcium oxalate (and calcium phosphate) ...	8
3. Uric acid	1
4. Cystine	1

These figures correspond to the results of my own chemical analyses (technique as described by Tovberg Jensen) and X-ray crystallographic examinations, which were kindly performed by A. Tovborg Jensen and A. Unmack.

In 30 concretions removed during the last 15 years the distribution of the groups was as follows:

	No. of cases
1. Magnesium ammonium phosphate (together with apatite, rarely calcium carbonate)	24
2. Calcium oxalate (and mixtures of calcium oxalate with colloidal apatite)	6
3. Uric acid	1
4. Cystine	1

Thus we find that magnesium ammonium phosphate is by far the most common stone in the dog. For that reason, measures should be taken to control the infection which must be the cause of the stone formation. Magnesium evidently is found only in struvite, and struvite precipitates only (Hammersten) when urine is infected with urea-decomposing bacteria, which produce an alkaline reaction in the urinary tract. Vitamin A deficiency, under certain circumstances, may dispose to stone formation, because the resistance of the epithelial tissues against infection is then greatly diminished. In the fox, urinary calculi were found in every one of the fox pups on a diet without vitamin A, while none was seen in those pups which received 100 I.U. daily (Basset, Harris, Smith, Yeoman).

Sompolinsky investigated urinary concretions from mink and showed that 12 out of 13 were alkaline infection stones and 10 of these were found in females, 9 of which were pregnant. As to dogs, I do not think that urinary infection could often be connected with pregnancy, because many of the bitches treated had never whelped; heat is more likely to be the origin of infection.

It is natural to think that alkaline stones could be treated by changing the reaction of the urine. Meyer has shown that even big bladder stones can be disintegrated by permanent irrigation of the bladder through a double catheter, but it often took one or two months, for which reason we cannot use this method in dogs.

If calcium oxalate is found, various factors, such as inadequate or unbalanced diet, may have influenced the stone formation. Hammarsten showed that, in the rat, urinary stones could be produced by means of a diet which was acidotic, poor in magnesium and rich in oxalic acid. Many of these stones would decalcify completely or diminish when the fully adequate diet was given. If the content of vitamins A and D was very low, the frequency of the calculi increased a little and the stones would be larger in size.

In man, Meyer found that oxalate stones are more frequent in patients suffering from tuberculosis of the bones than in other patients. This was due to the destruction of the bone tissues and consequent increase of the calcium content of the urine, which also could be produced by calcium deficiency where calcium is mobilised from the bones with great loss into the urine.

Naturally uric acid stones must be very rare, as uric acid is normally completely converted into allantoin and excreted in that form. Concerning the formation of cystine calculi, this is said to be the consequence of a lack in the organism of deaminating enzymes resulting in cystinuria. (Sjöberg and Nilsson.)

Both these types of calculi obviously occur so seldom that we may ignore their prophylaxis.

Cats

In the cat we have not observed any real stone formation, only sedimentation of the urine—and, as far as I could ascertain, always connected with urinary infection. The precipitated salts will be cemented together—especially in the male urethra—where they stick like a plug. This will cause immediate retention of the urine and distention of the bladder, often followed by paralysis.

If it is not possible to obtain an outlet from the bladder by gentle pressure, a puncture has to be made through the abdominal wall. We have never succeeded in making a catheter pass into the bladder.

Among 1,024 cats treated during the last fifteen years, thirty-five suffered from diseases of the urinary tract,

twelve died of urocystitis and uræmia, and in one case there was rupture of the bladder. On *post-mortem* examination, sediments were found in the bladder and urethra of nine of these animals, but in only a few cases were sediments observed before death.

In one cat, which was ten years old when he came to the clinic for the first time, sediment was not observed until his seventh return, when he was fourteen years old.

All the cats treated were males, and at least three of them were castrated. As sediments from only one cat have been chemically analysed (magnesium ammonium phosphate) we do not know whether the urinary infection is primary, but this seems most likely.

Summary

A clinical survey has been made concerning the occurrence of stone in dogs and cats treated at The Royal Veterinary and Agricultural College in Copenhagen during the last fifteen years.

Urinary calculi were found in seventy-two dogs (out of 11,291) and sediment formation of the urine in ten cats (among 1,024), *i.e.*, in approximately 0.6 and 1 per cent. respectively, of the total number of animals treated.

As to surgical treatment, cystotomia was performed on twenty-four dogs, and urethrotomia on thirty-six dogs. Kidney stones were not removed.

Recurrence of bladder stones was seen in only a few cases, but the tendency to recurrence of urethral stones is rather high, for which reason we often create a permanent fistula (eleven cases).

The operations themselves are not very risky, but the urinary infection present may be so severe as to cause death. (Judging from the *post-mortem* examinations, only four of the dogs operated on died in consequence of the operation.)

In the cats we found only sediments—no real stone formation. None was operated on.

Chemical and X-ray crystallographic examinations were made of thirty-two concretions from dogs. Most of them (twenty-four) were magnesium-ammonium phosphate, six were calcium oxalate, one uric acid and one cystine.

To prevent re-formation of urinary calculi after surgical treatment, the problem is to control infection, which is often the cause of the stone formation. If the calculi found consist of calcium oxalate, recourse may be had to alteration in the dog's diet and, in particular, to the addition of magnesia.

References

Hammarsten, Greta. (1938.) "Dietetic Therapy in the Formation of Calcium Oxalate Calculi in the Urinary Passage," II. *Skand. Arch. Physiol.*, **80.** (1940.) "Om Urinvägsstenar och deras Analys." *Nord. Med.* **7.** 1329. (1945.) "The Formation of the Nucleus of Stone in the Urinary Passages." *J. Path. and Bact.*, **57.** 375. (1946.) "Bildningen av aseptiska urinvägsstenar," II. *Nord. Med.*, **30**, 911.

Jensen, A. Tovborg. (1940.) "On Concrements from the Urinary Tract," II and III. *Acta Chirurg. Scand.*, **84.** 207, and 1941, **85.** 473.

Langner, T. Klarenbeek en Raabe, F. (1935.) "Zoutafzettingen in de urineweg bij de hond," *Tijdschr Diergeneesk*, **62.** 1179.

Lassen, H. Kriger, (1939.) "Spontaneous Dissolution of Renal Calculi." *Nord. Med.*, **2.** 1569.

Meyer, Johannes. (1927.) "Om Urinvejskonkrementernes Oploselighed. Disputats 1927, Kbhn."

Meyer, J. og Mogensen, Else. (1946.) "Om Dannelsen af Urinvejskonkrementer hos Patienter lidende af Led—og Knogletuberkulose." Finseninstitutets Jubilæumsskr. Kbhn.

Pflug, G. (1946.) "Krankheiten des Uropoetischen Systems," Wien.

Prien, E. L. and Frondel, C. (1947.) "Studies in Urolithiasis, I." *J. Urol.* **75.** 949.

Sjoberg, K. och Nilsson, F. (1940.) "Ett fall av cystinstenar hos hund," *Svensk VetTidskr.*, **45.** 197.

Sompolinsky, D. (1949.) "Urinary Concretions in Domestic Animals with Special Reference to Fur-bearing Animals," *Manedsskr. Dyrl.*, **58.** 401.

Stephenson, H. C. (1939.) "Urinary Calculi of Small Animals." *J. Amer. vet. med. Ass.*, **95.** 309.

Discussion

Major Hamilton Kirk, M.R.C.V.S. (London), who was the first opener of the discussion, said: I would like to pay my personal tribute to Dr. Krabbe for her first-rate contribution on the subject of urolithiasis. It has been a pleasure to read it.

In view of the limited time at my disposal, I propose to discuss the disease as met with in cats, X-ray diagnosis, and preventive treatment. Urolithiasis in cats presents a very difficult problem to the average practitioner and does not receive the attention it deserves.

Urolithiasis in the Cat

I have performed very many cystotomies in the dog but cannot recall ever having to remove a stone from the cat's bladder, and certainly never from the kidney. So that my experience agrees with Dr. Krabbe's, that urolithiasis in the feline is confined to urethral obstruction with particles of triple phosphate, and generally at a point just behind the penial bone.

Almost invariably the cat is a male, and although some people have said that the castrated male is mostly affected, I cannot accept that. The fact that the majority of cats are castrated in their youth has probably given rise to this erroneous assumption.

Preliminary Treatment.—As a preliminary measure the cat is restrained on an operating table and an attempt is made to dislodge any particles of grit from the penial urethra by gently drawing the thumbnail along the urethra, using the prepuce to protect the actual penis. In some cases one is fortunate enough to shift sufficient to allow a bead of urine to appear. If so, a very gentle pressure upon the bladder will cause a stream of urine and, thereafter, the animal may be able to do the rest. In old-standing cases it cannot do this because of a temporary paralysis of the bladder and detrusor urinae. Then the surgeon must complete the task. Unhappily, not many cases are easily disposed of and operative measures must be considered. Dr. Krabbe has never operated on the cat, but the following procedures are worthy of trial:—

1. Catheterisation;
2. Urethrotomy, or
3. Paracentesis vesicae.

The last-named is not recommended except as a temporary expedient, when time and other considerations make it entirely impossible to do more; or in order to avert a threatened rupture of the bladder.

The creation of a permanent urethral fistula in dogs, as recommended by Dr. Krabbe, does not commend itself to me. Only seven out of eleven of her cases did any good, and Dr. Krabbe herself realises the possible bad sequelae.

If the passage of a catheter is contemplated, followed possibly by urethrotomy, then the first essential is to put the cat under general anaesthesia, not only on humane grounds, but also because good work of such a delicate nature cannot be performed upon a struggling, pain-conscious, resisting patient.

Catheterisation.—Dr. Krabbe states she has never been able to pass a catheter into a cat's bladder; but if a suitable instrument is employed, and the urethra is not too tightly packed with deposit, then this can be done.

The anaesthetised male cat is placed upon its back, hind legs wide apart. The prepuce is pushed downwards with the thumb and first finger of the left hand, to expose the penis. Gray's sterile catheter (warmed, lubricated with acriflavine emulsion, and with its stilette in place) is inserted into the urethral orifice.

The point of the instrument is now directed downwards towards the table and slightly backwards. Gentle pressure is then exerted upon the catheter until the soft resistance caused by the curvature at the perineal arch is felt, when the point is directed towards the animal's head, the catheter then being horizontal with the table. The stilette is withdrawn.

The length of catheter which has entered will be an indication as to the location of its point. If no urine passes, the stilette may

be reintroduced to clear the orifice of obstruction. No force should be exerted at any time or there will be a possibility of puncture of the urethra or bladder.

The female cat is more advantageously placed when secured in an abdominal or upright posture, since the urethral orifice is upon the floor of the vagina. The vagina is so very small that the use of a speculum for locating the meatus is impossible; but by gently sliding the point of the catheter in a forward and slightly downward direction along the centre of the vaginal floor the instrument will be found to continue without resistance when the point has entered the meatus. This, actually, is situated about 3/16 to ¼ of an inch posteriorly to the os uteri.

Urethrotomy.—Unfortunately it happens too frequently that the catheter comes to a standstill in the male at or beyond the penial bone. Usually this is because there is so much sabulous deposit that the catheter actually packs it tighter and urethrotomy is the next move.

It is better to undertake this at once, than to continue poking about with a catheter for half an hour, all to no avail, but with the almost certain production of a very acute urethritis.

Having made the usual surgical preparations a small longitudinal incision is made directly over the site of the obstruction. Entry into the urethra is facilitated by taking the penis between the first finger and thumb of the left hand in such a manner that the urethra lies centrally between the two digits, and the skin over it is stretched by them.

Endeavour should be made to cut down upon the point of the catheter, provided this has passed beyond the penial bone, as the incision would be useless if made anterior to it.

Once the urethra is entered, the catheter is withdrawn and attempts are made (by pressure upon the bladder and in other ways) to withdraw or drive out the grit through the incision. It is generally found that the catheter can be passed through the surgical incision towards the bladder, and also in the reverse direction through the penis. Most, and probably all, of the deposit will be expelled along with the urine as one continues to press upon the bladder. The latter may even be flushed out with sterile water.

Post-operative Treatment.—There is no necessity to suture any of the tissues as healing is usually uneventful. However, to mitigate the possibility of infection it is very desirable to administer a course of penicillin for two or three days.

Although Dr. Krabbe frequently mentioned the deaths among her cases from secondary infection, I am rather surprised to find, throughout her paper, no mention whatever of penicillin or the sulphonamides.

X-ray Diagnosis of Stone

In a large proportion of cases of calculus in dogs, the employment of X-rays is of immense help. A good radiograph which includes the kidneys, ureters and bladder, will reveal the majority as opaque shadows, but such shadows must be distinguished from calcareous glands, phleboliths, etc.

In six out of nine of Dr. Krabbe's cases renal stones were discovered only upon *post-mortem* examination. It seems that a more habitual use of X-rays would have afforded an early diagnosis.

Uric acid, urates and cystine may fail to give a shadow, but in cases of doubt the urinary tract can be outlined by the intravenous injection of a contrast agent (Iodoxyl, Abrodil, etc.) which is rapidly excreted by the kidneys.

The bladder may be outlined by injecting into it a 20 per cent. solution of sodium bromide or a 12 per cent. solution of sodium iodide, after catheterisation: or by the injection of air. Tumours or calculi occupying the lumen would thus—in most cases—be revealed by radiography.

The urethra may be injected with lipiodil during fluoroscopic observation, or a radiograph may be taken immediately afterwards.

Preventive Treatment

In considering this important aspect of the matter it is well to bear in mind the eight or more predisposing causes of calculus and, as far as possible, effect their removal.

Predisposing Causes of Calculus

1. Feeding with a diet deficient in vitamin A.
2. Oxaluria (favoured by deficiency of vitamin B and D).
3. Inability of the urine to hold certain salts in solution and tendency for the more insoluble salts to separate out at different *p*H levels.
4. Infection. Opinions differ as to whether infection is a primary or secondary factor in the development of urolithiasis.
5. Stasis from any cause (prostatic hypertrophy, nephritis, tumour, etc.).
6. Inadequate fluid intake with consequent concentration of urine.
7. An excess of stone-forming constituents in the diet (*e.g.*, spinach, cocoa, tea, etc.); purins.
8. Hyper-parathyroidism is now a well-recognised actiological factor among humans.
9. Presence of a nucleus in the bladder such as colonies of organisms, slipped suture, blood clot, etc.

Nothing is more disheartening to a surgeon or to an owner than to find that an animal, having survived a brilliant operation, evinces symptoms of recurring lithiasis some months later. What the general practitioner needs, therefore, is a line of preventive treatment in which he can have reasonable faith; but fundamentally he must eliminate every causal factor.

Any prophylactic measure contemplated is bound to be of greater efficacy if the composition of the calculus is known, because stones of different content require different treatment. For instance, we know that if the urine is abnormally acid, there is danger of the precipitation of urates; if it is too alkaline, then phosphatic calculi may form.

Cystine Calculi.—Contrary to Dr. Krabbe's experience, Dr. White found that cystine stones were very much more numerous in dogs and cats than had ever previously been suspected. As cystine is readily soluble in alkaline solutions, it is rational to attempt to keep the urine alkaline. This procedure is reported to have brought about the dissolution of cystine calculi in the renal pelvis of man and to have prevented their re-formation.

The fluid intake should be increased so as to keep the cystine level in the urine below a concentration at which it is likely to crystallise out.

To increase the alkalinity of urine, sodium bicarbonate or ammonium carbonate may be given orally; or a combination of sodium or potassium bicarbonate and citrate would be excellent.

Phosphatic Calculi.—To render the urine more acid is of value in preventing a recurrence of calculi composed of triple phosphate. This may be achieved by giving sodium acid phosphate (5 to 20 grs.) or hexamine camphorate (5 to 10 grs.) or ammonium chloride (5 to 20 grs.) in water every day for an unlimited period.

The sabulous deposits of a cat's urinary system consist of phosphates and it would be a great prophylactic advantage to prescribe for such animals drugs which will ensure the maintenance of an acid urinary reaction.

Normally, of course, the urine of dogs and cats is acid but it generally becomes alkaline in the presence of cystitis.

I recorded a classic case many years ago in which 1,530 calculi, ranging from the size of a millet seed to that of a tangerine, were removed from an Airedale bitch. The largest stone weighed 6¾ oz. Preventive treatment was 5 gr. urotropine three times weekly along with 10 grs. sodium acid phosphate. The dog had no recurrence of lithiasis and died naturally five years later.

Dietetically one may induce an alkaline urine by employing mainly a vegetarian diet, whilst an acid urine is obtained by giving a diet rich in proteins and fats but poor in sugar. A diet rich in vitamin A is also generally recommended and is provided in the administration of olive oil, cod-liver oil or butter.

Calcium Oxalate and Uric Acid Calculi.—As these calculi are of much less importance I must, on account of time, omit detailed reference to them.

Renal and Ureteral Calculi.—Whilst renal and ureteral calculi are rare in the small animals, when they do occur they give rise to great pain. In such cases papaverine sulphate is highly recommended on account of its local analgesic effect and its property of lowering tonus of smooth muscle. Its toxicity is low, though no more than 5 grs. should be given in one day. Average dose 1 to 2 grs. hypodermically or orally.

Belladonna is also useful in spasm of the bladder due to calculus or prostatic irritation.

In all cases of urinary lithiasis I believe in offering or forcibly administering large quantities of water. Objection to this is raised

on the ground that the bladder is too quickly filled in cases of obstruction. This is admitted whilst the obstruction is still present, but the first consideration should, of course, have been its removal. Otherwise a fairly well filled bladder enables the surgeon more easily to locate it and exert pressure upon it in order to force particles out of the urethra. Additionally, of course, the more the bladder is flushed with water the less opportunity is afforded for salts to concentrate, or for the accumulation of organisms, etc., and the less alkaline will the urine become.

Mr. J. S. J. Lauder, M.R.C.V.S. (Altrincham, Cheshire), the second opener of the discussion, said: It was with very great pride and pleasure that I accepted the invitation of the Organising Committee to act as one of the openers of the discussion on this paper. Pride, that I, a comparatively young practitioner, should be selected for this task in the midst of all the eminent veterinarians of this and many other countries who are present here this afternoon; pleasure because it gives me the opportunity of congratulating Dr. Krabbe on the excellence of her paper. I realise fully the long years of patient research and skill that she must have devoted to amassing such an amount of detail. It is of great interest to learn of these conditions as they occur in other countries, and I very much regret that these opportunities of exchange of international knowledge have been so restricted, as I feel that they are of inestimable value in the elucidation of our common problems.

I would also like to congratulate Major Hamilton Kirk on his opening remarks, particularly his reference to the treatment of sabulous deposits in the urethra of cats, which until recently I have always found extremely difficult to deal with.

The first thing that struck me on reading Dr. Krabbe's paper was the extremely small number of cats that she had treated over a period of 15 years, and I would be interested to know whether this is due to the small number of cats in Denmark or whether it is due to the fact that the cat when ill does not receive the same attention accorded to the dog. Without having kept any records I am sure that I have treated well over 1,000 cats this year and I have certainly had more than ten cases of urolithiasis, mainly obstruction of the urethra.

Dr. Krabbe has dealt in great detail with the chemical composition of stones but as a general practitioner I am afraid that the facilities for chemical analysis are not so readily available to me; as a brief guide, however, I would like to draw your attention to the various shapes and colours assumed by stones of different chemical composition. They are roughly divided into five groups as follows:—

1. Calcium oxalate stones which are dark grey or brown in colour, rough, irregular and very hard. The surface may be covered with spicules and spines. The "mulberry" calculus of this type is frequently found in the bladder.

2. Uric acid and urate stones are smooth, hard and ellipsoid or spherical in shape and may be crystalline, laminated or mixed calculii. Colour varies from a golden brown to deep yellow.

3. Phosphate stones are composed chiefly of calcium phosphate and ammonium magnesium phosphate with varying amounts of calcium oxalate and carbonate. This type of stone frequently recurs and is associated with infection of the urinary tract, by urea-splitting organisms. The amorphous phosphate calculi are light grey in colour, very soft and consequently difficult to remove intact from the urinary tract. The calcium phosphate stones are hard and white in colour. The ammonium magnesium phosphate stones are smooth, dark grey in colour and harder than the mixed amorphous stones.

4. Cystine stones are usually crystalline, a yellow brown or green in colour and have a smooth surface. When mixed with phosphates they become rough and granular.

5. Xanthine stones occur rarely and are a reddish brown colour.

I would now like to say a few words about the aetiology of calculii. Probably the most common cause is urinary stasis combined with infection of the urinary tract. Coliform streptococcal and staphylococcal organisms are those most commonly isolated. The formation of stones appears to be due to the urea-splitting properties of these organisms which, by the liberation of NH_3, swing the *p*H of the urine over to the alkaline side which is more favourable to the precipitation of calcium phosphate and carbonate.

Dr. Krabbe has already mentioned vitamin A deficiency as another probable cause and I would like to quote an example. Benedict and Behrel have reported the effect of feeding a group of four Dalmatians on a vitamin A deficient diet for eleven months, at the end of which period it was found that two dogs had developed multiple vesical calculii, one had a sandy deposit in the bladder, while the fourth was normal. These calculii were composed of ammonium and calcium phosphate with small quantities of carbonate.

Another possible cause of stones is hypoparathyroidism. The relationship between this condition causing increased calcium excretion and lithiasis has been emphasised by Barney and Mintz[2], who claim that 4·5 per cent. of cases in the human subject are due to this cause.

The majority of cases of urolithiasis require surgical interference for successful treatment. In cases of urethroliathiasis where there is complete retention of urine I have found it advantageous to remove the urine by tapping the bladder through the abdominal wall. By this means it is possible to relieve the pressure on the stones and in a number of cases this allows the stones, particularly if small, to become dislodged and passed normally. With cases of sabulous deposit in the urethra of the cat which cannot be moved by any other method, I have recently adopted, with success, the procedure of performing a laparotomy, making an incision on the dorsal wall of the bladder and passing a metal probe down the urethra from the inside of the bladder and thus pushing out the obstructing material. For medicinal treatment following the surgical removal of stones I have found Chelidonium tablets, one *t.i.d.*, of considerable value in preventing recurrence, but I have not been using them for a sufficient length of time to know if this is a permanent cure.

Medicinal treatment of urolithiasis has proved singularly inefficacious, but recently Schorr[3] in America has advanced a new line of treatment in the human subject involving the use of oestrogens and aluminium hydroxide gels which may have some application in veterinary medicine. Oestrogenic substances, by lowering the calcium and increasing the citric acid and aluminium hydroxide by reducing the phosphate content, should serve to prevent the precipitation of these relatively insoluble electrolytes. The stones, in dealing with which these chemical alterations should prove of service, are those composed of calcium phosphate, calcium carbonate, magnesium phosphate, magnesium ammonium phosphate and calcium magnesium ammonium phosphate.

Orally administered, citric acid is largely metabolised in the body and only a very small percentage escapes in the urine. When fed as sodium citrate the resultant increase in urinary citric acid is entirely due to elevation in urinary *pH* by the sodium ion. The oestrogenic hormones, on the other hand, increase the urinary citric acid without increasing the *p*H generally, with a concomitant reduction in the urinary calcium excretion. This two-fold action of the oestrogens serves to enhance calcium solubility without the disadvantages associated with the use of an alkalinising agent. Indeed, it is a reasonable inference that the lower incidence of renal stone in women may be due to the higher excretion rates of citric acid which are reached during the greater part of the menstrual cycle as a result of the elaboration of oestrogens by the functioning ovary. Citric acid levels may rise during the menstrual cycle to a height of 1·5 grammes for 24 hours, compared to the normal 0·4 to 0·7 gramme for males.

Aluminium hyroxide gels.—Stone formation of the type for which this régime is advocated depends not only on the calcium but phosphate ions as well. In order to reduce the phosphate ions advantage has been taken of the influence on phosphate excretion resulting from administration of an aluminium hydroxide gel (amphojel). The mode of action of amphojel rests on its formation of a highly insoluble aluminium phosphate in the intestinal tract which is entirely excreted in the stool as such. The amount of phosphate available for resorption through the gut is correspondingly reduced. This reduced resorption results in a lowering of the serum phosphate—a more complete tubular resorption of the phosphate ions, hence a reduction in urinary phosphate excretion. In other words, phosphate excretion now takes place largely through the stools instead of through the kidney. This I feel is a line of preventative treatment that could profitably be pursued by our research workers and, in conclusion, I would like to see some more research done into the methods of earlier diagnosis and prevention, because, after all, urolithiasis has been recognised for over 300 years. Samuel Pepys records in his diary how he was

operated on, without chloroform, for "the stone." Yet even to-day we are not much further forward in methods of prevention which would obviate the necessity of surgical interference. If we had some method of diagnosing the condition in the very early stages of development I am sure we could arrest the development of stones and prevent the necessity for the emergency measures that calculi nearly always demand.

I would like once again to thank Dr. Krabbe for her most interesting paper and I am now looking forward to the stimulating discussion which I am sure it will evoke.

References

[1] Benedict, S. R., & Behre, J. A. (1931.) "Analysis of Whole Blood; Determination and Distribution of Uric Acid." *J. Biol. Chem.* **92.** 161-169.

[2] Barnet, J. D., & Mintz, E. R. (1934.) "Some Newer Conceptions of Urinary Stone Formation." *J. Amer. med. Ass.* **103.** 741-743.

[3] Schorr, E. (1945.) "Possible Usefulness of Oestrogens and Aluminium Hydroxide Gels in Management of Renal Stone." *Amer. J. Urol.* Vol. **53.** No. 4.

General Discussion

Dr. J. Gajentaan (Amsterdam, Netherlands) having congratulated Professor Krabbe on her paper, said he would try to make some remarks about his research in Amsterdam. He hoped they would understand him. They had many cats in Amsterdam (there were many very high houses and on every floor there were one or two cats), so they met many cats in their practice.

First of all he missed, in all that was said that afternoon, any reference to one of the very easy methods of making the stony sediments in cats come out or, better, go in. They used only a record syringe with a small and short needle without a point; they filed the point off so that there was no sharp point, thus avoiding the possibility of making any wounds in the urethra. Then they filled this syringe with water only, inserted the nozzle into the urethra and pressed. Pressing produced two effects: first, the urethra was widened a little and then the sediment could be pushed back into the bladder. It was very easy, and in 100 per cent. of the cases would allow the urine to come through. So first the sediment was brought back into the bladder and then the urine flowed out in rather a big stream. He never tried to catheterise the bladder because he did not need the catheter, for when he used his syringe he was always successful; it never failed.

He was very glad to meet Major Hamilton Kirk, for he had read one of his books. He learned from him that one of the theoretical means of combating the stony sediments was to give no fish. His own opinion, however, was as follows: It was very remarkable that every fortnight before the war he saw one or two cats that had this affection; when their country was occupied by the Germans meat was unobtainable and they could only feed their animals with fish, but since 1940 he had never seen cases of sandy stones in a cat: perhaps, however, that was too much to say—maybe he had seen three cases up till now, *i.e.*, one every two or three years. After the war, too, they did not have so much meat to give to cats and it was remarkable that, although the cats got very much more fish than before, they had never seen those affections. His own opinion was that the condition had something to do with the kidneys. He was not sure about it, however; nevertheless he always treated the kidneys, with rather good results.

Mr. Joh. C. Peters (Rotterdam, Netherlands): It was rather strange, but his experience in Rotterdam differed somewhat from that of Dr. Gajentaan in Amsterdam. Before the war he, too, saw very many cases of urethra trouble in cats, not only in the male but also in the female. In a case in a female he did not catheterise it but did a puncture of the bladder. He washed it out with saline solution and the cat recovered. His experience, that the removal of the pressure by puncture of the bladder, or that compensation with pressure from outside, could be a great factor in removing the obstruction, was the same as Dr. Gajentaan's, but he used a cone-shaped needle—the instrument that was used to inject the human lacrymal duct—and as a catheter he employed the same instrument as that used to enter the lacrymal duct of human beings. It was a very fine instrument, but the thin elastic solid catheter bougie also was successful.

Regarding the cause of the deposits, he thought that the lack of vitamin A could be a great factor: also, the feeding of much fish—there was excessive feeding of fish in Rotterdam to-day, as before the war. It was a sort of smoked herring and it did not do the animal much good. They liked it and there were many cats that were fed only on that fish. Before the war there were many deposit cases: during the war he saw hardly any; now the cases were appearing again.

In dogs, in his practice, it was a very rare thing to find urethral stones. He had some cases, however, and he never found big stones in the bladder, only small ones, which also could cause obstruction. He performed the operation that Dr. Krabbe mentioned, the making of a permanent fistula, in a case that came for the second time in a state of uraemia, and he had great success in other dogs, too.

In cats he did not succeed. He did it once but the wound closed and the urethra was obliterated. In his opinion little wounds were caused by the sharp crystals. They could be a great factor in causing the retention of urine, because from time to time he found animals in which he could pass the catheter easily but they could not pass urine. When he took the catheter away, at the same time he used gentle pressure on the bladder. First he got a stream and in a very short time the stones. He could repeat that process many times, but he thought the spasm caused by the pain could be a very important factor in the retention of urine. It had only the objection that obstruction and retention could be caused by obliteration caused by the spasm also.

Miss O. Uvarov (Ewell, Surrey): She thought they had all learned quite a lot from the useful contributions of Professor Krabbe and Major Hamilton Kirk and the other speakers. It was, of course, an enormous subject, and in the few minutes at her disposal she was not going to cover a tenth of what she would like to say. As to the formation of stones, Dr. Krabbe, in her paper, had said that in some cases we did not know where they were formed. In her opinion, in a number of cases these signs were quite definite. One certainly got some that were movable and they might go from the kidney into the urethra and so on, but one also definitely got some that were completely static, particularly with reference to that awful menace of cystine stone formation in the male urethra, and that particularly in some types of dog—Dalmatian and Irish terrier. In that connection she would like to quote a paper which was written by Dr. E. G. White some four to five years ago, where he gave an analysis of the formation of stones, the chemical composition, shape, and susceptibility to them.

She had found cystine stones, particularly in the urethra of Irish terriers: in three cases they had to be operated upon more than once. At the first operation they had an ordinary urethrotomy. An X-ray was taken, the obstruction was relieved and yet, in one case anyhow, within three months the whole thing recurred. Again an X-ray was taken and only two small stones were revealed. There was a complete obstruction, however, and a second urethrotomy had to be performed. On this occasion 49 calculi were removed, the point being that the two stones revealed by the X-ray were not cystine stones, they were ordinary phosphate calculi. All the others were not. Since then she had been told that quite a lot of these cystine stones were actually formed inside the urethra, and sometimes one would not find them in the bladder, so that was a slightly misleading type of urolithiasis with which one had occasionally to contend.

Then, with regard to the shape of stones: she was very interested in Mr. Lauder's classification. In her opinion that was a very important point. She did not think the shape was actually altered by rubbing in the bladder as suggested by Dr. Krabbe. Admittedly a certain amount depended on rubbing in that way, but she thought the shape depended mostly on the chemical composition—and there again Dr. Peter's suggestion that the retention was due to the pain of the spikiness rather than the actual size of the stone was very interesting.

In regard to the symptomology (due to calculi), she found that the symptoms were quite divergent, because there was nothing like the acute pain that one encountered in cases of stone in the ureter, as compared with an almost indifference that one got with, say, a calculus in the bladder. Some dogs took no notice of it. They lived for years with a stone in the bladder if it could not be removed—provided it was a smooth variety of stone—so that it was a very important point.

The next thing that Dr. Krabbe mentioned was the reaction of urine. She had said that the reaction in a normal dog was slightly acid; perhaps it was a little more acid in this country. She (the speaker) found it was markedly acid and sometimes it was very difficult to change its reaction. She would like to ask Dr. Krabbe if she found rheumatism a symptom in these early cases where stone formation was present, and also if enlarged prostates were found in the male dogs.

In the cat she found that it was possible to pass a catheter, but it must be a very fine catheter and a silver one: she failed to pass anything except a very fine silver catheter. It was a great privilege to have with them Major Hamilton Kirk, who was a pioneer in the X-ray of small animals in this country, and she was very interested to hear him emphasise the gentleness with which he passed these catheters, in cats particularly. She would like to

ask him, as he was an expert on the X-ray of dogs, what was the time taken to outline a kidney when he used anything like "ureselectan." She had tried to use "ureselectan" by intravenous injection and had in quite a number of cases failed to show up the kidney. She was quite sure that Major Hamilton Kirk had several cases of radiology with which he could help them.

Professor Brion (Lyon) addressed the meeting in French. Following is a translation: He would like to ask Professor Krabbe what was the percentage of cases of cystine bladder-stones among all the cases she had treated in dogs and cats? For several years he had been very much surprised by the number of those cases which he found during his research work. If one analysed the stones, not superficially, but by cutting them in two, one would find very easily that about one-third of them were of a cystine origin. He discovered that from his own research work and among the collections at his disposal at the school where he was teaching. He must also add that if one took the urine of healthy animals, in a considerable number of cases tests would show the existence of cystine crystals which could very easily be detected because they had a brilliant appearance. They were very clear and they floated in the urine; sometimes giving an impression of a firework. He had found that this was a very important fact. It showed a deviation in the metabolism of amino-acids; one of the functions of the liver was to destroy them and eliminate them through the urea, but if the liver did not act properly then they were eliminated in the form of amino-acids in the urine; those which were insoluble, such as cystine, were precipitated and could be agglomerated in calculi. He had also found that, once the body had been affected by this kind of disease, there was no possibility of suppressing this faculty of retaining these acids. Therefore, once an animal had been affected by this, and even if one performed an operation, one would always get a new formation of crystals. Hence the only possibility, once the operation had been performed, was to prevent the future agglomeration of these prisms.

The Reply

Dr. Agnete Krabbe (Copenhagen, Denmark): It was difficult for her to understand what had been said and, particularly, to speak in a hurry, but she would try to answer their questions as well as she could.

To the first opener of the discussion, Major Kirk, she had not very much to say except to thank him for his observations, but she would try to make some reply.

Her experience as to the treatment of cats was rather limited, compared with Major Kirk's. If there was no obstruction of the urethra by concretions, then maybe the bladder might be emptied by gentle pressure. As had been stated, urine was passed subsequent to the insertion and withdrawal of a catheter. If there was a real obstruction, however, she thought one could not pass a catheter.

In cases of severe pyelitis or pyelonephritis, and maybe cystitis, it would always be very difficult, if not impossible, to combat the infection, whatever the method employed—at least—to get completely rid of the infection.

Speaking of the detection or, maybe better, non-detection of nephrolithiasis, she quite agreed with him that it depended upon good X-rays, but she thought it often might be difficult, even with that, to detect small kidney stones, and possibly kidney stones were not so rare as they thought. She would like to know if they always conducted *post-mortem* examinations of the animals which had suffered from urolithiasis, and if they had looked through records of the *post-mortem* examinations which, for instance, had been done in their institutes and seen how many cases they found in dogs and cats which had not been detected while they were alive. She had hoped that she would have managed to do that before she left, for the period from 1934 until now, but she had done so only for eight years; in this period, however, it seemed as if there were more kidney stones than they supposed. She also would like to know how often Major Kirk thought he found kidney stones at all.

As to prevention of the calcium oxalate stones, she wondered if Major Kirk was able to make the urine so acid as to avoid precipitation? He had asked about the use of sulpha drugs and penicillin; she had noted, however, that the operations and medical treatment would be the more commonly known aspect of the problem and therefore she excluded them from her paper. Moreover, the cases she mentioned went back to 1934; penicillin treatment was not then discovered and sulpha drugs were not used for animals, so they could not treat them with these agents.

It was amusing to hear that their dogs and cats had to avoid spinach and tea; she did not think that in her country the pets got much of these, so that she herself wondered which kind of calcium oxalate they could have in their food.

In reply to Mr. Lauder, they had not treated so many cats; maybe they had many more cats there, judging from the surroundings where she lived now in London. (Laughter.)

Mr. Lauder had spoken about the shape of the stones, and she agreed that there were certain differences between the stones depending upon their composition, but one could not be sure, even if the shape appeared to be very characteristic, that a stone was what one thought it was. She had seen stones which were so characteristic of calcium oxalate that one felt confident that one could tell it without making any chemical analysis, and when she received that analysis she found that she had been mistaken, so one could not judge stones by their shape.

She did not think that they had seen very many enlarged prostates.

They had often entered the bladder through the abdominal wall, and when the pressure and the pain were relieved the urine flowed again. They had not tried removing the stones by means of cystotomy and then pushing them through the urethra, but it seemed to her that would be a useful procedure.

She was very glad to learn what Dr. Gajentaan had told them about the use of the syringe to push the stone back into the bladder. They had not tried that, but would do so next time they got stone in the cat. It was also interesting to hear that he had good results in treating the kidneys, but he did not state what sort of treatment it was. In cats the obstruction probably would be infective sediment and therefore any treatment which could be carried out to remove the infection would be very useful.

She quite agreed with Dr. Peters that wounds had a great tendency to close when one formed a permanent fistula. They often had to pass the catheter for a very long time, or perform the operation on dogs once more when the opening had closed up.

They had found cystine in only one dog; it was very interesting to hear that Miss Uvarov found it often in Irish terriers. She did not know of any dogs which got stones of any special sort, except that she had heard of Dalmatians with uric acid stones, uric acid being more common in these dogs. She had read about cystine from Swedish authors, and even in that country there were only a few dogs which had suffered from cystine stones. She would repeat that she could not agree that shape gives a clue to the chemical composition of a calculus.

Professor Brion had spoken of finding a very high percentage of cases of cystine stone and asked how many they had. They had only one cystine in a total of 32 stones. She thought that the stones they had seen—they had some which were not from the period she had mentioned—had been of the shape to which Professor Brion had referred.

The Chairman, concluding the session, said that he regretted very greatly that they had not more time to devote to that subject. He was sure, however, that they would all go home filled with the intention of making further investigations and perhaps setting up enquiries in their own districts. They would feel that an excellent paper had been given by Dr. Krabbe, well supported by Major Kirk and Mr. Lauder.

R.S.I. HEALTH CONGRESS AT EASTBOURNE, 1950

The Right Hon. Earl de la Warr, P.C., J.P., will be President of the Health Congress to be held at Eastbourne from April 24th to 28th, 1950, by the Royal Sanitary Institute. The preparation of the programmes of the sectional meetings and conferences to be held during the Congress is well in hand and particulars will be announced shortly. Special arrangements are being made to show films of public health interest.

Once again Lt.-Col. J. A. Dixon, T.D., M.R.C.V.S., has been appointed recording secretary of Section D (Veterinary Hygiene).

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MODEL BY-LAWS FOR IMPROVING FOOD HYGIENE

The Minister of Food has issued to local authorities in England and Wales a model for by-laws which they may make for securing the observance of sanitary and cleanly conditions and practices in connection with the handling, wrapping and delivery of food for human consumption. Such by-laws do not cover the whole field of food hygiene but supplement existing statutory measures.

Some desirable provisions have had to be excluded because of current shortage of materials and equipment, and the model may be added to from time to time. The suggested provisions, which cover such matters as personal hygiene, cleanliness and good order of equipment, cleanliness of wrapping material, and the deposit and removal of refuse, have been drafted with a view to their application in both urban and rural areas and to every type of food handling trade.

THE DISPOSAL OF ANIMAL CARCASES

By

A. GINSBERG

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From the very earliest times man has endeavoured, either by means of burying or burning, to dispose of domestic animals which have died naturally or were otherwise unfit for human consumption. The burial of a carcase was by no means a safe method, as many diseases could spread by the pollution of the ground and the subsoil water or both. Besides, if the carcase was not buried sufficiently deep, wild animals could take possession of pieces of meat and thus become responsible for spreading disease, sometimes over wide areas. Although the practice of burning was safer, neither this nor the former means of carcase disposal took into consideration the economic value of dead animal matter.

In the interest of hygiene and national economy, methods have been sought during the last 30 years which would eliminate the danger of spreading infection and at the same time salvage valuable organic and inorganic matter, thus recovering at least a certain percentage of the loss which the death of a domestic animal has inflicted upon national economy. At present several methods of disposal of animal carcases are in operation. All are based on the same principles, viz., the destruction of the contagion and the recovery of valuable raw material for the production of feeding stuffs, grease and fertilisers. Whilst the practice of burying and burning carcases still prevails where up-to-date disposal facilities have not yet been introduced,[17] the thermal method of utilisation has established itself all over the world.

The most primitive means of thermal utilisation is the boiling of the infected meat in an iron vat over an open fire. This method, still in use in some small abattoirs in Eastern Europe mainly for sterilising pork infected with *Cysticercus cellulosae*, is objectionable from the hygienic as well as the economy point of view.[14] The introduction of steam under pressure for the sterilisation of meat was, therefore, a great improvement. This method was welcomed in those abattoirs on the Continent where the law allows a certain class of infected meat to be passed as conditionally fit after cooking. This system is useful where a carcase undergoes sterilisation for retail sale in the "Freibank."[3, 13, 14] It is, however, uneconomical and absolutely useless for the disposal of animal carcases. Where large-scale utilisation takes place more efficient methods have to be adopted. At present three thermal systems, known as the "wet," "dry" and "thermo-chemical rendering" processes, are in use.

"Wet rendering" is the older method by which the steam has direct access to the raw material in the digester. The latter is charged with the animal tissues and water to about three-quarters of its capacity. Steam is then turned on and passed directly into the tank to boil the contents. After the time required for cooking has elapsed, the tank water is removed, freed from fat and evaporated so as to concentrate all extractive juices and meat bases which are of high nutritive value. This method recovers from the raw material about 16.6 per cent. in bone and meat meal and 7.9 per cent. as grease. The fat extraction from the bone and meat meal is most unsatisfactory as between 15 and 20 per cent. remains in these final products.[9] This, of course, lowers the keeping quality of the latter as the fat undergoes disintegration. The processing time takes over eight hours and the fuel requirements are far too high compared with the output.

To simplify the process, increase yields, reduce cost, time and labour, was the ideal of the disposal plant constructor. The solution was reached by the introduction of the "dry rendering" process of "Iwel." In this method the steam no longer has direct access to the tank contents, but is turned into the double-steel plate jacket of the horizontal tank which is equipped with rotating arms for the agitation of the raw material during the time of processing. Animal matter is charged into the tank without the addition of water, as the main idea is that it should cook in its own moisture, eliminating the troublesome and wasteful tank water. By the end of the processing the remaining moisture, now in a vaporous state, is exhausted or drawn off by a vacuum pump and deodorised. The almost dry contents of the tank are transferred to a steam turbine where the fat extraction takes place (Fig. 1). This method not only simplifies handling and working, but it reduces operating expenses, securing a much higher output and profit than the "wet rendering" process. It is sanitary, economical and hygienic and the proverbial nuisance of the old-time knacker's yard, viz., its offensive odour, is reduced to an absolute minimum or eliminated altogether.

The equipment consists of an "offal washing unit," "bone crusher," "horizontal double steel plate tank," "steam turbine-centrifugal fat extractor" (Fig. 2), "fat settling and refining tank," and a "grinding, screening and sacking unit" (Fig. 1). The bone crusher is no longer an essential part of the equipment as whole carcases can be put into a large-sized tank-digester if necessary. They are crushed into small pieces by the continuous agitation of the beating arms, aided by the vacuum and a high temperature.

The main idea of "Iwel's" dry rendering process has been adapted by other constructors with certain modifications or new technical details, making little or no difference to the final output, time or economy. A better fat extraction rate is still being sought as this final product yields the best profit. To squeeze more grease out of the meat and bone meal, "Hartmann of Berlin" introduced a hydraulic press, claiming that the results are better than those obtained with the "Iwel" steam turbine-centrifugal fat extractor. Several other firms, such as, for instance, "Venuleth & Ellenberger," "Niessen," "Escher & Wyss," tried to solve the rendering process by other modifications.[9, 10, 13]

The "dry rendering" systems are still not perfect, but the average fat extraction rate is fairly satisfactory, as only 6 to 8 per cent. remains in the meat and bone meal. About 27.3 per cent. of the latter is recovered, that is, one-third more than in the "wet rendering" process. It shows good keeping qualities and its protein content is in the region of 60 per cent., that is, about 15 per cent. higher than in the "wet rendering" process.[9] The time of sterilisation is reduced substantially and on an average it takes only 3 to 4 hours compared with 8 to 10 hours in the "wet rendering" process. This, of course, makes the fuel consumption favourable and reduces the over-all expenses of production.

When selecting new "dry rendering" disposal equipment it should be borne in mind that the machinery must destroy effectively all organisms, utilise the raw material to its utmost limits, and save time, fuel, and labour. Two separate tanks, one for the cooking, the other for the drying of the raw material, should be avoided as it raises the cost of production. One horizontal tank which does

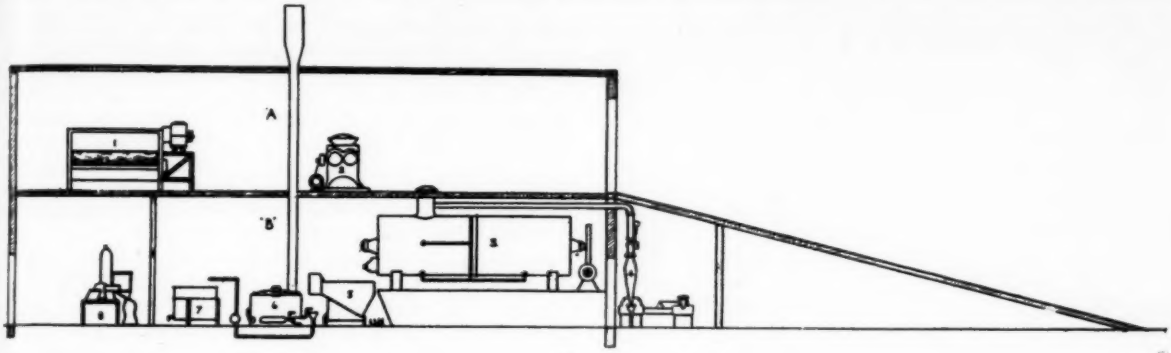

FIG. 1.

Disposal plant fitted with a dry rendering apparatus of the Industrial Waste Eliminators, Ltd., system: A—"Unclean" department; B—"Clean" department; 1. Offal Hashing and Washing Unit; 2. Bone and Carcase Crusher; 3. Dry rendering tank—digestor with charging dome on its dorsal surface; 4. Vacuum pump and condensor; 5. Truck; 6. Steam Turbine-Centrifugal Fat Extractor; 7. Fat Settling and Refining Tank; 8. Grinding and Sacking Unit.

FIG. 2

Disposal plant of the Edinburgh Corporation Abattoir. Note "Iwel's" dry rendering horizontal double steel plate tank and steam turbine-centrifugal fat extractor.

all the work with a charging dome on its "dorsal" surface, makes separation of the two disposal plant departments much easier, allows the charging of the digester to its full loading capacity, and reduces time and cost (Fig. 1). One has to agree with Moegle[10] that the future belongs to the system which will utilise the raw material in the simplest way and avoid a bone crusher, centrifuge, hydraulic press or benzine. The less the carcase is handled the less danger exists of spreading the disease and causing bad odours.

If a higher ratio of grease is desired, use has to be made of the thermo-chemical process in which extraction by benzine or some other chemical solvent reduces the fat content to 3 per cent. and, according to some reports, even to 2 per cent. There exists divergence of opinion as to the value of the meat and bone meal, as opponents claim that it is unwillingly taken or even refused by livestock. My own investigations so far neither refute nor support these claims. It is, however, true that the thermo-chemical method is more suitable for large establishments. It also salvages a grease clear and light in colour which is, therefore, preferred by soap manufacturers to the fat extracted in the "dry rendering" process.

To prevent the spread of infection it is not enough to sterilise dead animal matter without taking proper precautions against reinfection of the final products. Strict isolation of the raw material is a necessity which cannot be over-emphasised. To achieve this fundamental demand the lay-out of the plant has to be so arranged that isolation of the two principal departments will be simple but efficient.

A modern disposal plant should consist of two main parts, an "unclean" and a "clean" department,[10] the former being the place in which dressing, cutting and *post-mortem* examination take place (Fig. 1). This is the room where the infected material is received and is, therefore, the unclean part of the disposal plant. Adjoining it should be a hide store or curing cellar and a small laboratory for the veterinary surgeon. The "clean" department, on the other hand, represents the part of the plant where the disease-bearing organisms are destroyed by heat and the once dangerous raw material transformed into valuable, safe and hygienic products for use in agriculture and industry. It consists of the space required for the disposal machinery, storage space for the final products, and a small office.

To make the construction of the plant as practical as possible, both departments should be in one building, the "unclean" on top of the strictly isolated "clean" one (Fig. 3). If the building site shows a slight natural slope, the "unclean" department may be almost on the same level as the rest of the terrain, when a short bridge will suffice. Otherwise a ramp has to be constructed which may serve a dual purpose, being an entrance to the "unclean" part and at the same time a roof for some storage place or garage beneath (Fig. 1). In front of the *post-mortem* room there should be a receiving platform which must be well drained for easy cleansing and disinfection. The lorry bringing the carcases must never enter the building.

In connection with the "unclean" department there must be a dungstead. The German legislation of 1939 demands that this should be built from impervious material and be composed of three chambers. Except for anthrax carcases, which have to be utilised unopened, all other gastro-intestinal content is deposited there. The three

chambers are to be filled successively and emptied in the same order after the time laid down by legislation has elapsed.[16]

An important link in the prevention of reinfection of the final products is also the strict separation of the personnel employed in the two departments. Those working in the "unclean" must not be allowed into the "clean" department or *vice versa*. If, however, for any reason the personnel have to go from one part to the other, all sanitary precautions have to be taken to prevent a spread of infection into the "clean" part of the plant. Separate provision of cloakrooms, lavatories and showers must be made for each department. The workers have to be instructed to change their working clothing before leaving the plant.[5, 16] It has been also demanded that they should live in dwelling houses provided by the factory on its own site, this being a precaution against the possible spread of disease to the livestock or nearby villages. Furthermore, the German legislation prohibits the keeping of pigs and poultry on the factory site for the same reason.[8, 16]

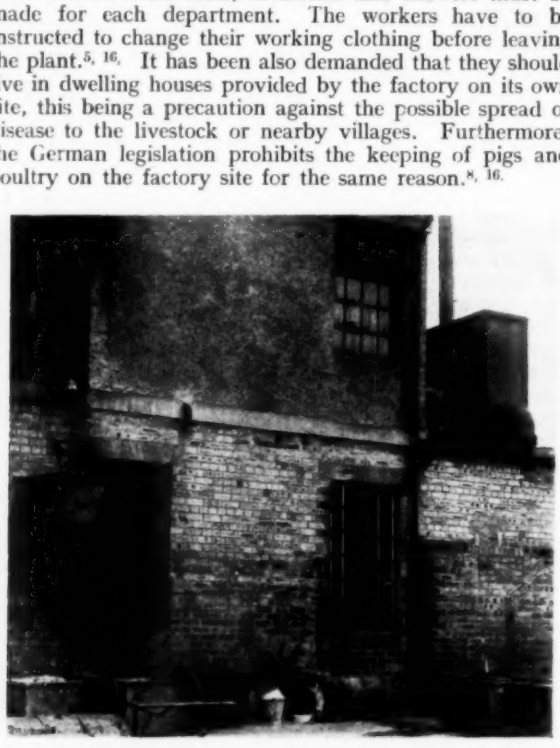

Fig. 3

Disposal plant of the Edinburgh Corporation Abattoir. Note two-storey building and hoist for lifting condemned meat and offals into the "unclean" department. On the roof to the right is the "Odour Condensing Unit."

In order to avoid the mistakes of the past and prevent the nuisance of the old knackers' yard the following points have to be borne in mind when a new disposal plant is about to be erected:—

(1) Location and construction of the plant, and
(2) Method of disposal and effective fume control.

The site selected should, if possible, be in the centre of the supply district, at least two miles from any dwelling area and not under consideration for development as such for a minimum of 20 years. It must be within easy reach of a good road and preferably not far from a railway line, so that the construction of a siding should not incur any great expense or give rise to other difficulties. The ground must be suitable for building purposes and should be dry and porous. A site which forms a natural drainage area or which is marshy, damp or liable to flooding, is completely unsatisfactory.

Abundant water supply is an absolute necessity and particular attention must be directed towards this question during the selection of a site. Soft water is preferable, as that containing considerable amounts of magnesia and lime will form scale in the boilers and cause unnecessary trouble. Where deep wells have to be drilled the cost of installation and future pumping must be taken into consideration before deciding on the site. Even if water is supplied from the municipal system, an emergency source must be available.[2, 6, 8, 10, 16]

The building should be constructed of concrete and steel throughout. This has the advantage of a lasting quality, is economical, fireproof, sanitary, and little affected by vibration from the machinery. The interior surfaces of the walls have to be flat, smooth, and easily cleansed. Smooth Portland cement plaster seems to be a good material[6] for this purpose, at least to a height of 6 feet, if the cost of glazed bricks or tiles cannot be met. All joints between walls, floors and ceiling must be covered to facilitate cleaning. The ceiling of the "clean" department should have a flat surface and be at least 15 feet above floor level. The type of ceiling for the "unclean" department depends upon the choice of roof, but it should be so constructed as to avoid the collection of dust and be of good height. The floors must be of an impervious anti-slip type, carefully drained so that all parts can be easily and properly washed down. A slope of the floor towards the draining inlets of about 3 inches is usually quite sufficient. The drain should pass through grease traps, especially in the "unclean" department, be of generous dimensions, easy to clean, and designed to retain gases. There should also be adequate facilities in the "unclean" department for dressing, cutting up, and *post-mortem* examination of carcases, whilst overhead rails, hoists and easily accessible water taps save labour and time. The construction of the roof is important as it helps to solve the problem of good ventilation as well as lighting.

Ample direct natural light is essential and the ratio provided for abattoirs, viz., one-fourth of the floor area of the working rooms, should also satisfy the demands of a disposal plant. For the construction of windows and screens, steel frames and glass of a heat-absorbing type should be used; insect screens are desirable.

The location and number of artificial lights has to be carefully determined. This should be similar to that in abattoirs, that is, on the average, not less than 20-foot candles, but if necessary 50-foot candles may be permitted. Adequate but not too intense lighting makes work easier and safer.

During construction any kind of rat harbour has to be avoided and all buildings must be rat-proofed.

A satisfactory ventilating system is of utmost importance. There must be an ample installation of exhaust fans and ducts not only to dispense with offensive odours, heat, steam vapour and dust, but also to introduce fresh air.

Sewage disposal, a problem in the "wet rendering" system, has lost some of its importance in the "dry rendering" process, this being due to the elimination of tank water. Nevertheless, proper facilities have to be provided for handling the effluent, which is largely cleaning water. As it comes mainly from the "unclean" department it is highly infected and has to be sterilised by steam before leaving the plant. The introduction of the effluent into the local sewerage system is, according to Moegle,[10] not advisable as it may give rise to unpleasant odours in the kitchens of the nearest dwelling houses. Biological

filters find their supporters and opponents, the latter preferring a mechanical cleaning of the effluent from its larger particles and then what they term a natural biological filter, in the form of a fish pond.[10, 15] The removal of all dead animal matter must be carried out as quickly as possible, so as to avoid decomposition, smell, and the spread of disease.[15]

A very important item in the disposal of animal carcases is transport. The vehicles have to be of a construction which allows all collected material to be hidden in a watertight container which can easily be charged and cleaned. To conform with such a demand, Krupp, Daimler and Mercedes produced before the last war special tank-lorries with a tight-fitting door and a winch for hoisting carcases, the design being somewhat similar to the tank of a petrol-lorry. The most common size is a 3-ton vehicle, but 1- and 5-ton lorries would be very useful; the former, mainly for the collection of small animals and the latter for large supply districts, when a much wider area can be served at once.[8] The regular cleansing and disinfection of the lorries must be carried out in a special paved and well-drained enclosure of the plant to eliminate the danger of spreading infection.

The outlining of a supply district for the disposal plant has been a matter of long-standing controversy and although German technical and agricultural advisers did reach an agreement on this point, the discussion cannot be considered closed as technical progress during the last years has brought about many changes. According to the German solution, the boundaries of the supply district need not be those of a county, but may, if necessary, overlap parts of several. They are influenced by the number of livestock only, 60,000 to 80,000 adult stock (horses and cattle) over 12 months of age, being the minimum requirement if full use is to be made of equipment and labour. This number, according to the above experts, should yield on the average 1,000 carcases per annum. However, where road communications are easy, the supply districts have to be enlarged to cover an animal population of about 200,000 adult stock and one large or several smaller abattoirs, as this has proved beneficial to the income of the plant.[8, 9, 10, 13] These supply requirements have been arrived at by calculations based on the cost of processing and output of disposal machinery prior to 1939. Since then, technical improvements have altered the aspect of utilisation and nowadays it is quite safe to assume that even small plants will yield a profit if properly equipped and managed. Therefore, the outlining of supply districts should not be specified as a pattern based on the size of the machinery, but local conditions and requirements have to be given first consideration. The area should be of a size which allows the collecting of any dead animals by the disposal plant in a minimum time. The German idea of collecting centres at " strategic " points of the district has advantages and disadvantages.[1, 8, 10] Whilst a single tour is no doubt a financial burden on the plant, the transport of a carcase by the owner himself from farm to the collecting centre, on the other hand, may spread disease and prove a greater loss to national economy than a few gallons of fuel and some extra labour.

With regard to the question of ownership, the idea prevails that a disposal plant is primarily a sanitary and only secondarily an industrial undertaking. To safeguard the demands of hygiene and those of the legislation dealing with contagious diseases, these plants should be under public ownership. They may be leased to private individuals but the State or local authority must have the necessary powers to safeguard the interests of Public and Animal Health. They must reserve to themselves the right of sanitary supervision by the appointment of their own full-time veterinary officer. The German legislation of 1939 dealing with the disposal of animal carcases endorsed these ideas by granting priority to public ownership.[1, 4, 7, 8, 9, 10, 12, 16] In Belgium the plants are a private enterprise, but the State leases the supply districts by public auction for a period of ten years. The leaseholder has to adhere strictly to all regulations and the plant is under full-time veterinary supervision. In Holland disposal plants are, in the majority, State-owned, but private and co-operative undertakings also are in existence.

Remuneration received by the owner of a dead animal varies to a great extent. If the system is based on a sound organisation, an average of half to two-thirds of the market value of hides is paid, provided, of course, that the hide of the animal is intact, the carcase not decomposed and the State has not paid compensation. Pigs are valued according to weight. Sheep fetch a slightly better price if the wool is in good condition.[10, 12, 16]

The over-all planning should be in the hands of a special department attached to the Ministry of Agriculture and Fisheries. This in turn must appoint full-time veterinary surgeons, whose duties include sanitary supervision of the plant and production, *post-mortem* examination of all carcases, and the compilation of *post-mortem* records and certificates. Close collaboration with the Government veterinary officer, veterinary practitioner and research worker in tracing diseased herds is essential and would help in the eradication of disease and supply most valuable scientific material.[4, 7]

A modern plant should save labour expenses. On the average five people are considered sufficient[8] to run a medium concern, provided full use is made of automatic loading, weighing and packing machines, cranes, conveyors or overhead rails and elevators. The works-manager should possess a thorough knowledge of the duties of all disposal plant personnel. In Germany, as a rule, a candidate to a manager's post must have, besides technical ability, some knowledge of the economy of the industry. He should also be able to replace the engineer or driver if necessary. To acquire this knowledge it is understood that a candidate will undergo at least three months' training in some large disposal plant.

The question as to whether a utilisation plant should be erected within the walls of an abattoir still remains a controversial matter. The main objections to setting up a disposal plant within the walls of an abbatoir appear to be: (1) that the cost of the installation is too great compared with the actual turnover; (2) that the possibility exists of fresh meat coming in contact with rejected carcases, offals, etc., and (3) that the air is contaminated by offensive odours. To-day these objections are overruled by the progress made in construction of disposal plant equipment. At present equipment of almost any size can be installed to correspond with the actual requirements of an abattoir; in a properly planned slaughterhouse, the contact of fresh meat with inedible carcases of offals is out of the question and by the introduction of up-to-date methods of fume control there should be no pollution of the surrounding air.[15] On the contrary, quick and efficient disposal of blood and rejected meat, as well as offals, not only reduces the danger of the spread of disease, smell and development of rodents, but brings a profit to the abattoir. It might be worth while to cite in this connection C. E. Dillon,[2] an American expert on slaughtering and the packing industry: " the rendering of inedible grease and the production of meat scraps for animal feed are highly

profitable and essential for the disposal of offal after slaughter. Because there is little grease stock in storage, and because the demand far exceeds the supply, a favourable market will very likely continue for a long time. . . . No other department (disposal plant) in a slaughtering plant shows a greater percentage of profit" (Figs 2 and 3).

The final products derived from utilisation of dead animal matter are primarily feeding-stuffs, fertilisers and grease, besides glue, gelatine, hides, etc. The feeding meals are rich in protein, minerals and vitamins, and are an excellent supplementary food, especially in the raising of pigs and poultry.[6, 8, 13] Their amino-acid composition makes them an extremely useful supplement to cereal foods, while adding little to the bulk of the daily ration. Eleven different feeding meals, prepared mainly from inedible by-products of America's meat-packing industry, are listed by the Association of American Feed Control Officials[6]: (1) Digester tankage, (2) Meat scraps or meat meal, (3) Digester tankage with bone, (4) Blood meal, (5) Blood flour, (6) Raw bone meal, (7) Steamed bone meal, (8) Special steamed bone meal, (9) Animal liver meal, (10) Animal liver and glandular meal, (11) Extracted animal liver meal.

According to the demands of the Association, the first two feeding meals should not contain more than 4.4 per cent. phosphorus. In the case of this percentage being exceeded, they have to be named " . . . per cent. Protein meat and bone meal tankage " or in the case of product No. 2 as either " . . . per cent. Protein meat and bone meal " or " . . . per cent. Protein meat and bone scrap." Number (3) of the above listed feeding meals should contain more than 4.4 per cent. of phosphorus. These meals are finely ground animal tissues without the addition of horn, hoof, hair and stomach contents (traces of the latter are unavoidable and are, therefore, permitted). According to the German legislation bone and meat meal should not contain more than 10 per cent. of fat, but at least 50 per cent. of protein, of which 85 per cent. must be digestive.[16] By the introduction of the " dry rendering " system the latter demands are quite easily met and as far as the fat extraction rate is concerned, even exceeded.

Next on the list is blood, a feeding-stuff containing 75 to 85 per cent. of protein.[6] This rich concentrated product appears on the market as " Blood flour " or " Blood meal," according to the method of production. Whilst the former is dried by spraying the blood into a current of warm air, the latter is obtained by means of the " dry rendering " process. The keeping quality of " Blood flour " is remarkably good and it is fine and odourless. The production of this commodity, however, is more expensive and requires more space than the method of preparing " Blood meal " by the " dry rendering " process.

" Raw bone meal," recorded as No. (6) in the above list, must contain not less than 23 per cent. of protein and is obtained by the cooking of fresh bones in water under normal pressure. The excess of fat and meat is removed and the residue dried and ground. It is a product typical of the meat-packing industry, but not the disposal plant.

" Steamed bone meal " and " Special steamed bone meal " are dried ground bones which have been cooked under pressure. The latter contains at least 65 per cent. of bone calcium phosphate and is obtained during the process of extracting gelatine and glue. It has a very low fat content, about 6.25 per cent. of protein and at least 65 per cent. of calcium phosphate.

" Animal liver meal " and " Animal liver and glandular meal " are, as a rule, produced only by the meat-packing industry. So also is the " Extracted animal liver meal " obtained from the residue of animal tissue from which a large percentage of vitamins and/or minerals have been previously removed.

The proportion of fat, protein and phosphates in the feeding meals has to be in the ratio demanded by the market. The fat content, as already mentioned, has to be kept as low as possible. This increases the keeping quality of the meals and raises the disposal plant's profit as grease pays best and is practically always in demand. The proportion of protein and phosphates depends upon the amounts of bone and meat present. If the bone content is high, the phosphate content becomes higher and the protein content lower.

The finely ground meal is used for feeding purposes, while the coarser grains which are separated by screening and those animal tissues not suitable for animal foods supply the fertiliser. The rendered grease is in great demand for technical purposes. Lean animals yield 5 per cent., whereas fat pigs render well up to 40 per cent. of the carcase weight. The grease should be light in colour and according to the German legislation at least 97 per cent. saponifiable.[9, 16]

By-products which pay a fairly good dividend are bristles, hair, wool, hoof, horn and hides. The last-mentioned, because of damage during the terminal stages of illness and by changes which take place after death, fetch on the average 40 per cent. less than those from abattoirs. Nevertheless, there should be skilful handling of the skinning operation of all carcases where legislation does not demand total condemnation.

Conclusion

To develop the process of carcase disposal, uniform legislation should be passed covering the whole country, making it compulsory for animal carcases or parts of them which are unfit for human consumption to be handed over to local utilisation plants. Supply districts must be outlined and established, new disposal plants erected and the existing ones, if adaptable to the new scheme, modernised. The machinery selected should be of the " dry rendering " type, but whatever system is chosen has to guarantee the efficient destruction of all disease-bearing organisms and ensure favourable yields whilst incurring only moderate working expenses. Transport facilities have to be provided which will prevent any spread of disease or contamination of air. Public ownership should receive priority for the very same reasons that the private slaughterhouse had to give way to the public one. A full-time veterinary officer directly responsible to the Ministry of Agriculture and Fisheries should be attached to each plant.

References

1 Brander, G. C. (1949.) *Vet. Rec.* **61.** 36.
2 Dillon, C. E. (1947.) " Meat Slaughtering and Processing," St. Louis, pp. 64-76.
3 Edelmann, R. (1943.) " Text-book of Meat Hygiene," London, pp. 209-213, 8th ed.
4 Ginsberg, A. (1949.) *Vet. Rec.* **61.** 36.
5 Goldmann. (1941.) *Berl. Tierärztl. Wschr.* **36.** 432.
6 Inst. of Meat Packing (1945). " Beef, Veal and Lamb Operations," Chicago, pp.301-424, 4th ed.
7 Kiddle, P. (1948.) *Vet. Rec.* **60.** 692.
8 Lockau, U. (1941.) *Berl. Tierärztl. Wschr.* **36.** 435.
9 Miessner, H. (1948.) " Tierseuchen und ihre Bekampfung," Hannover, pp. 340-356, 7th ed.
10 Moegle, E. (1941.) *Berl. Tierärztl. Wschr.* **16.** 189.
11 ——. (1942.) *Ibid.* **47/48.** 352.
12 Osinski, J. (1949.) *Medycyna Weterynar.* **1.** 42.
13 Ostertag, R. (1932.) " Lehrbuch der Schlachvieh und Fleischbeschau," Stuttgart, pp. 1167-1188.

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THE VETERINARY RECORD
November 12, 1949

TUBERCULOSIS ERADICATION : AN ALARMING DEVELOPMENT

ALL concerned for the eradication of tuberculosis from the herds of this country must have read with surprise and apprehension the reply made recently by the Minister of Agriculture (*Vet. Rec.* **61.** 746) to Mr. Hurd's question as to when a start would be made with a scheme for the establishment of areas reserved for attested cattle—an essential step towards the systematic elimination of the disease. Not only did Mr. Williams announce that he had nothing to add to the reply given to the same member on April 4th, when "a few difficult questions remained as regards the financial provisions of such a plan, which he hoped might be resolved in the near future," but intimated that its postponement might be included under the £6 million cuts representing the share falling to his Department of the Government's economy measures following upon the devaluation of the pound, and involve deferment for a short period. Admitting, in answer to Sir Thomas Dugdale, that this was a very undesirable way of saving expenditure, the Minister added "but all economies are more or less painful". On November 2nd came the definite intimation by the Minister of a temporary deferment of the introduction of the proposed scheme for the eradication of tuberculosis in cattle on an area basis.

With all the economic uncertainties facing the country, it is quite clear from the foregoing exchanges that yet another disastrously prolonged chapter is about to be written to the unhappy story of the frustrations with which this Association and its allies, the Veterinary Staff at the Ministry and the National Farmers' Union, have had to contend in their efforts to ensure the health of our livestock, increased production of milk and meat, and a safe milk supply. Neither we, nor the medical profession, can be content indefinitely to accept pasteurisation other than as an essential complementary measure to secure that the bulk of the milk used for human consumption is free from tuberculous infection. From the public health aspect, so calamitous and widespread an infection of the dairy herds of this country, with its inevitable repercussions on human health—more particularly that of the juvenile population—must be combated at its source, and that process surely should rank amongst the exceptions which the Government is making to its curtailment programme. From the animal health aspect, tuberculosis eradication means enhanced productivity and, with a properly directed and sufficiently far-seeing policy, the opportunity of effecting untold improvement in the national herd of the future.

As a direct outcome of the latest crisis there arises the fundamental question : is the health of our livestock with which is associated inseparably the health of our people, regarded by Parliament as a matter of vital concern ? If so, far from acquiescence in postponement of action, assuredly there will be from all parties a demand for acceleration in the application of any measures essential to the removal of this national reproach.

[14] Rozp. o. urzed. bad. zw. i. miesa w kraju. Zal. No. 16, 29, I. 1929. Polish Meat Inspection Act.
[15] Sauer, B. (1941.) *Berl. Tierärztl. Wschr.* **9.** 104.
[16] Tierkorperbeseitigungsgesetz vom 1. Februar 1939. German Disposal of Animal Carcases Act.
[17] Ust. o zwal. zaraz. chor. zw. Now. 1938, par. 17. Polish Diseases of Animals Act.

CLINICAL COMMUNICATION

ACUTE, FATAL POISONING IN SHEEP DUE TO INGESTION OF COMMON SORREL

(*Rumex acetosa*)

T. G. COWARD, M.R.C.V.S.,
Barnstaple, N. Devon

This case is recorded because it appears that there have been no definite recorded cases of death amongst stock in this country through eating sorrel. It is also of interest that a plant not generally regarded as highly toxic should produce such an acute condition.

Case Report

A field on a grazing farm in N. Devon was re-seeded. The grass, however, failed to grow and instead the field yielded a close crop of common sorrel, almost literally to the exclusion of all other plants, with the exception of a few thistles.

On the morning of June 30th a few sheep broke into the field and the farmer decided to put the entire flock of 90 Devon close-wool ewes and lambs with them in order to "eat down the seed heads." By the same evening it was noticed that one of the ewes was staggering, but the farmer put this down to its having over-eaten and did not worry.

Early next morning one sheep was found dead and 12 acutely ill and the flock was at once removed from the field. During the next few hours four more died and the remainder gradually recovered.

The symptoms varied from a marked ataxia, which was exhibited by all the animals seen in the early stages of the illness, to prostration followed by death. The ataxia was very severe. An affected animal, if forced to walk, would stagger along, reeling from side to side in a drunken fashion and often falling. Those animals which subsequently died became unable to rise and eventually completely prostrate. They lay on their sides in a coma showing hyperpnoea and frothing slightly at the mouth; the pupils were greatly dilated.

All affected sheep were given an oily purgative which, however, did not appear to alter the course of the illness. The less affected animals gradually returned to normal.

Post-mortem examination, although somewhat cursory, revealed no macroscopical lesions. Chemical analysis of ruminal contents from one dead sheep revealed an oxalic acid content of 200 parts per million stated as the anhydrous acid.

Discussion

Although common sorrel is known to be rich in oxalates (oxalic acid is known commercially as "salts of sorrel") it is not usually regarded as very toxic and, in fact, in some country districts and on the Continent is incorporated in salads in view of its bitter flavour.

Speaking of the Order Polygonaceae, Lander states that some species "are held to be responsible for poisoning—although the records and our knowledge of the active principles are scarcely such as to give the basis of a well-founded narrative," and that the species of Rumex "are well known to contain oxalates which may possibly account for the alleged poisonings."

The symptoms in this case are quite consistent with those described for oxalate poisoning. Bull, describing chronic

oxalic poisoning in sheep through continuous ingestion of *Oxalis curnua*, noticed stiff gait, loss of control of the hind quarters, or in some cases the fore quarters, inability to rise; some died suddenly whilst others lingered for some time.

It is interesting to speculate why in this case the condition was so acute, the first signs being seen barely 12 hours after the sheep entered the field. Probably a combination of several factors was responsible:—

1. The excessively large quantity of the plant eaten in a short period.

The plant greasewood (*Sarcobatus vermiculatus*), which has frequently caused large losses of sheep in the United States, contains notable quantities of oxalic acid. Experimental work has shown that sheep must eat a toxic quantity within a comparatively short time to be poisoned (1.5 lb. in a few minutes). If the plant is eaten slowly a sheep may consume two or three times the lethal dose in 24 hours without being affected. In the present case the sheep had been on rather poor, very arid pasture which had become " burnt " due to the hot dry summer. When they found themselves amongst a mass of more green and moist plants they probably ate very greedily. Possibly the sour flavour is attractive to sheep. All the affected sheep were ewes and it may be that the lambs did not eat so ravenously.

2. The weed in this field had reached the mature and seeded state at which period it may be most toxic. This is said by some to be so in the case of sheep-sorrel (*Rumex acetosella*).

3. Steyn states that animals on a rich calcium diet are resistant to poisoning with oxalates and oxalic acid owing to the precipitation of insoluble calcium oxalate in the gastro-intestinal tract. Sorrel is known to grow in an acid soil and is an indication of the need for liming pastures. That the plant should grow in such profusion in this field is surely a sign that there is an acid, lime deficient soil in the neighbourhood. The diet of the sheep was thus probably deficient in calcium.

Summary

A case of poisoning of sheep due to ingestion of common sorrel is recorded. The symptoms varied from a marked ataxia to prostration, followed, in five animals, by death. The possible reasons for the acuteness of the condition are discussed.

Acknowledgments.—My thanks are due to Mr. J. T. Greatorex, M.R.C.V.S., for his advice on preparing this case for publication and to Dr. E. G. C. Clarke, of the department of Chemistry, Royal Veterinary College, for the chemical analysis.

References

Lander: "Veterinary Toxicology." Baillière, Tindall & Cox. 3rd Edition, 1945.
Steyn, D. G. "Toxicology of Plants in South Africa."
Bull. (1929a.) *Austral. Vet. J.*, 1929. **5.**
Huffman, W. T., & Couch, J. F. (1942.) Year Book of Agriculture, U.S. Dept. of Agriculture.

Biological Standardisation.—A report of the proceedings of the third session of the Expert Committee on Biological Standardisation, held in London in May this year, has been published in the *Chronicle of the World Health Organisation* for July, just issued.

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Weekly Wisdom

Civilisation is self-discipline.—Lord Elton.

QUESTIONS IN PARLIAMENT

Ministry of Agriculture (Economies)

Mr. Hurd (November 2nd) asked the Minister of Agriculture if he will specify the undertakings which will be affected by the proposed reduction by £6 million in the expenditure of his Department.

Mr. T. Williams: My right hon. Friend's statement referred to preliminary estimates of my Department's expenditure which would have reflected the cost of developing as well as maintaining present services. The full effects will, therefore, result partly from a deferment of development and partly from an acceleration of economies already under consideration. The main headings under which the economies will be effected are, in addition to those mentioned by my right hon. Friend, the disbandment of the Women's Land Army, slowing down the programme for replacement of agricultural and land drainage machinery held by county agricultural executive committees, a number of miscellaneous savings at the county agricultural executive committees and in headquarters' services and a temporary deferment of the introduction of the proposed scheme for the eradication of tuberculosis in cattle on an area basis.

. . . . . .

Milk Yield

Mr. H. D. Hughes (October 31st) asked the Minister of Agriculture whether he will make a statement on the results achieved in raising the milk yield of dairy cows as a result of more scientific farming; and the measures taken by his Department to eradicate disease.

Mr. T. Williams: It is estimated that for the United Kingdom as a whole the average milk yield of milk per cow in milk or in calf has increased from 509 gallons in 1946-47 (June to May) to 566 gallons in 1948-49. Milk yields are influenced by a number of factors, and it is not possible to say to what extent the increase is due to those referred to in the Question.

NOTES AND NEWS

Diary of Events

Nov. 12th.—Dinner of the Southern Counties Division, N.V.M.A., at Southampton (Polygon Hotel), 7.30 p.m.

Nov. 12th.—Meeting of the Biochemical Society, at the London School of Tropical Medicine, Keppel Street, W.C.1, 11 a.m.

Nov. 16th.—Meeting of the Royal Microscopical Society, in the Hastings Hall of B.M.A. House, Tavistock Square, W.C.1, 5.30 p.m.

Nov. 18th.—Annual Meeting of the North Wales Division, N.V.M.A., at Ruthin (Wynnstay Hotel), 2 p.m.

Nov. 23rd.—Dance of the Ayrshire Division of the Victoria Veterinary Benevolent Fund Ladies' Guild, at Western House, Ayr.

Nov. 23rd.—Annual Meeting of the Scottish Branch, N.V.M.A., at Glasgow (George Hotel, 235, Buchanan Street), 2.30 p.m.

Nov. 25th.—Meeting of the Royal Counties Division, N.V.M.A., at Aylesbury (Ye Olde Bull's Head Hotel), 2.30 p.m.

Nov. 25th.—Autumn Meeting of the Eastern Counties Division, N.V.M.A., at Cambridge (Institute of Animal Pathology), 2.15 p.m.

N.V.M.A. Committee and Council Meetings

The following are the arrangements for meetings of Committees and Council of the Association to be held in London in November:—

Tuesday, November 15th:
11 a.m.—Parliamentary and Public Relations Committee.
2 p.m.—Organising Committee.
4.15 p.m.—Home Appointments Committee.

Wednesday, November 16th:
10 a.m.—Veterinary State Medicine Committee.
2 p.m.—General Purposes and Finance Committee.

Thursday, November 17th:
11 a.m.—**Meeting of Council.**

Friday, November 18th:
10.30 a.m.—**Special Meeting of Council.**

The Reduced Incidence of Scheduled Diseases

THE NEED FOR CONSTANT VIGILANCE AND PROMPT REPORTING

During the past two years there has been a striking reduction in the number of outbreaks of foot-and-mouth disease and swine fever in this country.

This period of comparative freedom from these diseases should not, however, lull us into a false sense of security, for these diseases are still prevalent in many other countries and these islands are always liable to be invaded by them.

In this position a special responsibility rests on every member of the profession; to keep the risk constantly in mind and to ensure that every suspicion is promptly reported. Occasionally the difficulty of diagnosis is real and in these circumstances the veterinary surgeon will wish to consult with the Divisional Inspector before he visits other premises.

Delay in suspecting and reporting an outbreak of a scheduled disease not only makes eradication more difficult but invites disastrous consequences.

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FLUORINE POISONING

Reports have recently been received by the Ministry of Agriculture and Fisheries of poisoning of livestock by fluorine emissions from different kinds of industrial undertakings including brick works, steel works and enamel works, using in their manufacturing processes soil, or other material, containing compounds of fluorine. The poisoning has been stated to be due to the animals feeding, over long periods, on pasture (and possibly foodstuffs) on which fluorine has been deposited from the air.

Veterinary surgeons who meet with any case in which livestock appear to be suffering from fluorine poisoning are asked to report the matter to the Ministry's Divisional Veterinary Inspector or Veterinary Investigation Officer for the area.

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PERSONAL

Births.—BARR.—On November 2nd, 1949, at Brunswick Square Nursing Home, to Janet, wife of John Barr, M.R.C.V.S., Penrith, a son.

CASE.—On November 2nd, 1949, at Guyn Mor Nursing Home, Cardiff, to Joan (*née* Farman, M.R.C.V.S.) and Robert Case, a son—Jonathan Robert Sully.

SAMBROOK.—On November 4th, 1949, at Little Abbey Gate, Tovil, Maidstone, to Joan, wife of Michael Sambrook, M.R.C.V.S., a son.

. . . . .

Captain P. C. W. Creagh, M.R.C.V.S.—The Registrar, Royal College of Veterinary Surgeons, 9, Red Lion Square, London, W.C.1, is very anxious to get in touch with Captain Pierce Cornelius William CREAGH, recently of Black Lion Yard, High Street, Leighton Buzzard, and the Shrubberies, Station Road, Woburn Sands, Bletchley, Bucks. Also recently at 6, Pen Street, Boston, Lincs.

If any practitioner has any knowledge of the whereabouts of Captain Creagh would he please communicate immediately with the Registrar as above?

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GLASGOW VETERINARY COLLEGE MEMORIAL PLAQUE

A memorial plaque to the graduates, students and staff of the Glasgow Veterinary College, who gave their lives in the two World Wars, was unveiled in the University of Glasgow Veterinary School, 83, Buccleuch Street, on Thursday, November 3rd.

The plaque, which was gifted by the Governors of the Veterinary College, was unveiled by Major Grey, a member of the former governing body and Vice-President of the Glasgow Veterinary Branch, British Legion (Scotland), and the Service of Dedication was conducted by Rev. Hamish MacIntosh, M.C., M.A., B.D., Chaplain of Glasgow University.

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R.C.V.S. Animal Management Examination

LIST OF SUCCESSFUL CANDIDATES

LONDON:

Berry, D. M.
Bunting, Miss J. A.
Clifford, R. J.
Cook, W. R. (Credit)
Evans, H. L. (Credit)
Ford, G. K.
Govaerts, L. V.
Herbert, W. J.
James, T. M.
Langford, S. H.
Larkin, P. J.
Malseed, J. R.
Manton, V. J. A.
Phipps, J. A.
Rossdale, P. D.
Silver, I. A.
Tiedeman, B. G.

LIVERPOOL:

Adams, H. S.
Bailey, Miss E. J. (Credit)
Barbour, R. L. J.
Benson, J. A.
Booth, F. R.
Bowen, D. T. E.
Crowley, A. J.
Harding, J. D. J.
Hedger, R. S.
Illingworth, H. M.
Jones, R. A.
Kiernan, N. S.
Lewis, E. O.
Makin, Bryan
Martin, B. A.
Morgan, T. D. (Credit)
Morris, J. E.
Mortimer, P. H.
O'Neill, Desmond
Owen, Anthony
Owens, Thomas
Phillips, G. D.
Pyke, B. N.
Stallard, L. J.
Wakeem, A. A.
Wilson, R.
Wright, G. W.

(To be continued)

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The Animal Health Trust's Poultry Research Station

Last July Dr. R. F. Gordon and his staff, at the Trust's Poultry Research Station near St. Ives, Hunts, moved from their improvised hutted accommodation into well equipped laboratories. These are now in full working order, and with its breeding flock of 300 Barred Rocks and Brown Leghorns, and some 1,500 pullets under progeny test, the Station is busy on several research problems.

Attempts are being made to build up strains of poultry resistant to fowl paralysis, a disease which is being investigated by the Station's pathologist, Mr. Darcel. Mr. Horton Smith, in the parasitology department, is working on coccidiosis. Search is being made for a cheaper and more effective drug than sulphamezathine, and the use of heated floors and the simultaneous treatment of chicks placed on contaminated ground are being investigated.

The bacteriology department is continuing the work on salmonella infections begun by Dr. Gordon and Mr. Buxton some years ago. This work is developing along two main lines, the first dealing with incubator and hatchery hygiene, and the risk of infection being conveyed on fluff at hatching time. The second line of research on the salmonella problem is the possibility of immunising the egg by the vaccination of the mother. Buxton's work has indicated that immune bodies are transmitted *via* the egg, and the eggs of vaccinated birds confer a certain amount of resistance on the chicks over the susceptible period. Respiratory diseases, including infectious coryza in poultry, and a disease of turkeys caused by monilia, a fungus (first recognised in the U.K. this year), are also the subject of research. Professor A. N. Worden, the Trust's biochemist, is investigating green yolks in eggs. Only two or three instances of these have occurred in batteries, and they were associated with a high greenstuff diet. Shepherd's Purse and Penny Cress are two plants known to give rise to green yolks. Attempts are being made to isolate the pigment responsible.

Some 800 pullets are housed in a converted cowshed, adapted to the Trust's design, using the labour-saving American deep litter system.

A start has also been made with the setting up of a Farm Livestock Research Station under the direction of Professor Miller. One interesting feature is a grain drying plant to cope with cereal crops from 400 acres. The plant is a modification of the one originally designed by the N.I.A.E. and has been built entirely with the Trust's own labour. A few "finishing touches" and modifications have yet to be made but the total cost will not exceed £1,250. Four binfuls of grain totalling 120 tons can be dried simultaneously at a cost for electricity of 10d. per hour without heat and 1s. 8d. an hour with heat. The conveying equipment costs 10d. per hour to run and conveys four tons of grain an hour. Total electricity cost for handling and drying damp corn is, therefore, 1s. 11d. per ton.

An extensive research programme has been mapped out, and herds of cattle and pigs are now being formed.

G. P. W.

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LEGAL NOTES

Dangerous Drugs Acts: What is a "Receptacle"?—The King's Bench Divisional Court ruled recently that a motor-car was not a "receptacle" within the meaning of the Dangerous Drugs Regulations, and upheld the conviction at Birmingham of a doctor who had left drugs in an unlocked case in his locked car at a cinema car park.

The point was raised on an appeal by Dr. Dhalipala Kame-

swara Rao, who had been fined £5 for failing to keep Dangerous Drugs "in a locked receptacle" which could be opened only by himself or someone authorised by him.

Lord Goddard, the Lord Chief Justice, giving the judgment of the court, said the doctor left the drugs in his car while he was in a picture theatre, and when he came out the car had been stolen. It was later found abandoned at Walsall. The doors had been forced and the drugs were taken out. His lordship said he did not think the regulations were too happily worded. They might be worded more strongly. He thought the regulations contemplated that Dangerous Drugs were to be permanently or regularly kept in some receptacle and not that at any particular moment there was a compliance because a lock was turned. He thought that it was impossible to say that a car was a receptacle within the meaning of the section. He also thought a house would not be a "receptacle" for drugs. A car might be a receptacle for luggage, but it had to be locked and unlocked according to whether a person was in it or not and there was no suggestion that the doctor kept his car locked whether he was in it or not.

Lord Goddard pointed out that the court was only considering the facts of this particular case. It was not speculating on what might be the result if there were different facts, such as a locked attaché case or a locker in which the drugs were kept in the car.

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WILD RABBITS INVESTIGATION

Research in the ecology and control of wild rabbits—which are so serious a menace to agriculture and, even if indirectly, to animal health—has been conducted under the direction of Professor A. N. Worden, M.A., B.SC., M.R.C.V.S., F.R.I.C., since 1946. The work has so far been financed by U.F.A.W., who have been directly responsible.

By arrangement with U.F.A.W., this work will now be supervised for them by the Animal Health Trust, to whose scientific staff at the Trust's Farm Livestock Research Station Professor Worden was appointed in January, 1949, as Nutritionist and Biochemist.

The work is being done by Miss W. M. Phillips, B.SC., and Miss N. Stephens, B.SC. It has had the co-operation of the County Agricultural Executive Committees of Cardigan, Carmarthen and Pembroke, the last of which has organised a "Land Improvement Scheme" based upon rabbit eradication in a coastal area of the country.

The effect of commercial trapping upon the rabbit population has been assessed by modern methods, and different control methods have been studied on a large scale.

Much useful information on the biology of the rabbit has been secured. A controlled experiment, begun in 1948 and now approaching completion, has been carried out to determine the effect of damage by rabbits to directly re-seeded pasture and its stock-carrying capacity.

Full reports on all this work will be available later.

Miss Phillips has, in addition, collaborated in some studies on the nutrition and ecology of the vole, from which it is hoped to obtain data useful for subsequent work in cattle and sheep.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the N.V.M.A.

THE TREATMENT WITH VITAMIN B$_1$ OF BRACKEN STAGGERS IN THE BOVINE

Sir,—With reference to recent communications (*Vet. Rec.* **69**, 549 & 693) regarding the efficacy of vitamin B$_1$ therapy in cases of suspected bracken poisoning, a brief account of a bracken feeding experiment which was carried out at this laboratory is given here. The details are relevant to the use of aneurin hydrochloride in bracken poisoning; a complete report of the experiment will be published at a later date.

Two stunted two-year-old heifers in fair store condition were fed entirely on *Pteris aquilina* from June 20th until a few days before their deaths which occurred on August 28th and 29th respectively. Among other observations, the heifers' temperatures were recorded twice daily. These did not rise above 102° until the morning of the 63rd day of the experiment (August 21st, 1949), when temperatures of 102·8° and 103·2° were registered. From this day onwards each animal received 200 mg. aneurin hydrochloride in sterile water intramuscularly *b.i.d.*

Until a few days before their deaths took place, the heifers ate the bracken greedily and apart from slight loss in condition, with staring coats, constipation and, at times, dullness, they appeared otherwise normal.

Details of the concluding days of the experiment were as follows:—

HEIFER 10

Date	*Temps. (Deg.)*	
21/8/49 a.m.	102·8	Apparently normal, eating bracken, ruminating, passing hard dark-red faeces.
p.m.	104·0	
22/8/49 a.m.	104·0	Ditto.
p.m.	104·2	
23/8/49 a.m.	104·2	Ditto.
p.m.	104·0	
24/8/49 a.m.	105·6	Dull, eating bracken, ruminating, faeces softer.
p.m.	105·8	
25/8/49 a.m.	107·6	Dull, not eating, diarrhoea, faeces positive to the benzidine test.
p.m.	107·6	
26/8/49 a.m.	106·8	Dull, recumbent, bleeding from anus.
p.m.	107·8	
27/8/49 a.m.	—	Found dead, evidence of straining with bloody diarrhoea.

Heifer 10 had received a total of 2,400 mg. aneurin hydrochloride between August 21st and 26th.

HEIFER 12

Date	*Temps. (Deg.)*	
21/8/49 a.m.	103·2	Apparently normal, eating bracken, ruminating, passing hard dark-red faeces.
p.m.	102·8	
22/8/49 a.m.	103·6	Ditto.
p.m.	104·0	
23/8/49 a.m.	103·6	Ditto.
p.m.	104·2	
24/8/49 a.m.	104·0	Ditto.
p.m.	104·0	
25/8/49 a.m.	105·4	Dull, eating bracken and ruminating, faeces still hard and negative to the benzidine test.
p.m.	106·8	
26/8/49 a.m.	105·5	Dull, not eating, diarrhoea, faeces positive to the benzidine test.
p.m.	106·2	
27/8/49 a.m.	107·0	Dull, inclined to stagger, spot of blood on nostril, blood clots in faeces.
p.m.	107·0	
28/8/49 a.m.	—	Found dead, evidence of straining with bloody diarrhoea.

Heifer 12 had received a total of 2,800 mg. aneurin hydrochloride between August 21st and 27th.

At the *post-mortem* examinations, the classical lesions of bracken poisoning (Stockman, 1917) were found, except that in heifer 10 these were confined to the peritoneum and to the abdominal organs.

It will be seen from the above data that under the experimental conditions described, doses totalling 2,400 mg. and 2,800 mg. aneurin hydrochloride, respectively, were ineffective in the treatment of bracken poisoning in these heifers. Even before the appearance of obvious symptoms such as persistent dullness, anorexia and diarrhoea, each animal had received a total of 1,600 mg. of the substance.

Yours faithfully,

Veterinary Research Laboratory, L. B. O'MOORE.
Department of Agriculture, Dublin.

October 28th, 1949.

Reference: STOCKMAN, S. (1917.) *J. comp. Path.* **30**, 311.

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GENERAL ANAESTHESIA IN THE CAT

Sir,—The July, 1949, issue of the *North American Veterinarian* states: "In the year 1947, 1,357 cats were anaesthetised at the Angell Memorial Animal Hospital, Boston, according to Dr. Gerry B. Schnells, and the mortality attributable to anaesthesia was 0·0037 per cent. It is fair to guess that mortality from anaesthesia anywhere else was much greater than at this Boston hospital where nothing interferes with the functioning of a complete and well-organised staff of clinicians, laboratory workers and nurses."

In the past nine months, January till September, 1949, 940 cats and kittens whose ages ranged from three months to 14 years have been anaesthetised at Hampton Animal Hospital, using the ether-oxygen method as routine procedure. Administration has been in the hands of six different nurses, depending upon duties. Of this number no cat has died during routine anaesthesia. Three of these

cats have been lost where, through force of circumstances beyond our control, namely, failure in delivery of oxygen cylinders, other makeshift methods have been used, *viz.*, chloroform-ether, ether, nembutal, intraval sodium, etc.

With results like these in our hands, we shall be very hard to convince that there is a safer method of anaesthetising cats and kittens than by the use of ether and oxygen.

Yours faithfully,

WILLIAM HENDERSON, M.R.C.V.S.,
Veterinary Superintendent.

National Canine Defence League Hospital,
Hampton, Middlesex.

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THE PSYCHOLOGICALLY ABERRANT CASE

Sir,—I could not agree more with Miss Joshua in her letter (September 24) in which she declares the need for our attention, as a profession, to the problem of "the psychologically aberrant case." Miss Joshua cites the special need of the dog; my only protest is that all animals lack veterinary attention and understanding in this sense, and the claim of the horse is probably at least as great.

Miss Joshua describes the case of an Alsatian dog with what would appear to be a form of the condition designated in psychiatry an "obsessional neurosis," which can in man prove difficult or impossible to cure, and it is a pity that the sequelae in this case are not available.

I am reminded of the behaviour of a mongrel dog owned by a friend of mine, which would for no apparent reason suddenly and excitedly bark always at a certain portion of a blank wall in the flat, and continue this behaviour indefinitely unless checked, as though it apprehended some intruder. The wall in question was several stories up and exterior, and there were no antecedents whatever to account for this tiresome behaviour. This dog also was otherwise entirely normal, and indeed a very gentle and affectionate animal.

Miss Joshua's case would seize viciously the base of its tail, and I am perhaps irrelevantly reminded of an animal (opossum) treated by me at the London Zoo, which had literally chewed off its own tail overnight, so that the several tendons were all that remained, hanging down like streamers. There was no history of pruritus. The words "mad itch" spring naturally to mind, but after simple amputation there was no further trouble and I can offer no explanation whatever for this extraordinary behaviour.

Apart from the well-known neurotropic infections, total insanity in animals is of very rare occurrence indeed, but the writer has seen, also at Regent's Park, a tamarin monkey which was completely and incurably "out of its mind." Indeed, I have never in my life imagined such gibbering dementia as this poor creature exhibited, refusing all food, standing trembling on its week hind legs, facing always the observer, its mouth agape and tongue protruding and quivering like a snake's, and its eyes starting out of its head in abject terror at the approach and even the presence of anybody. This animal had been placed and maintained in company with a number of squirrel-monkeys, many times its own size, and was driven completely manic by fear.

These, however, are special cases, and the general problem is that of the domestic animal. I have cited the claims of the horse. My reference is in particular to so-called "vice" in these animals—crib-biting, windsucking, weaving, and obsessive kicking in the stall, for example—all of which are common enough and familiar to most of us. Yet what have we, as a profession, to offer after all these centuries by way of therapy in such conditions? Only palliative measures are ordinarily available and these often enough fail. Yet assuredly true remedial treatments could and should be applicable. For example, may I suggest that crib-biting could be cured without the slightest doubt or difficulty by suitable (and, of course, temporary) low-tension electrification of the manger, so that the animal received a mild but sufficient shock whenever it seized the crib. I should be surprised if any animal would repeat its experiment more than three times, and since windsucking is usually a sequel to crib-biting, this should in effect provide a remedy for both. I think it probable that an electrical method would also readily lend itself to the cure of obsessive kicking in the stall, *e.g.*, a microphone suitably placed to pick up the noise of the impact of the hoof, and trigger off a similar mild punitive shock through suitably placed electrodes. Electrotechnically, such methods are simplicity itself and would be of negligible cost.

There is, again in the horse, that peculiar condition of "head-shaking," which received authoritative but sterile discussion in these columns some three years ago. This is a strange condition into which I believe we have no insight whatever. I have myself seen two cases, brought to the Royal Veterinary College at Streatley, in which the attacks were stated by the owners to be associated with work. In one case at least the hardest work generally failed to produce the slightest symptom for observation, yet at other times, at a slow walk, the animal would go into paroxysms of the condition such as made it a most uncomfortable ride and indeed almost unrideable. We were unable to adduce any explanation whatever in either case, and equally unable to provide any form of treatment. My suspicion is that this also may be an "obsessional neurosis," after the pattern of Miss Joshua's dog.

Be it noted that all these equine conditions are of recognised economic importance. Other equine conditions which, to my mind, properly come within the province of veterinary therapeutics are biting, viciousness in the stable, jibbing, and indeed "delinquency" in general. After all, when bolting, for example, is ascribable to the horse's tail, we resort to docking; and where vice in a mare is due to cystic ovaries we treat the case accordingly. Why should our professional responsibility be confined to such instances as these? Surely we are the proper authority, better qualified than the stockman or owner, to prescribe? But how limited is our lore in these and other allied matters!

Forms of behaviour in the ox to which our attention could be directed for the provision of therapeutic measures (as opposed to palliatives) are, for example, kicking during milking in the cow, and viciousness and psychological impotence in the bull.

In respect of the dog, as Miss Joshua states, instances are legion. There is the tragedy of the sheep-worrier and killer, and chicken killing, both conditions of notorious intractability once acquired; the case of the dog condemned by the court to destruction for some delinquency (and which the owner so often maintains alive at whatever cost in fines to himself); homosexuality and the many other sexual abnormalities which are encountered in canines; while, finally, one may mention hysteria itself, which in its common clinical form I think most practitioners will agree is not satisfactorily explained by Mellanby's dietetic concepts.

It is probable in the writer's belief that acquired (as opposed to innate) viciousness in most animals would be readily remediable by the correct therapeutic approach, for example, on the lines of intensive ECT in man combined with re-education. While admittedly in many cases this might not be considered worth while, in many other cases, as with valuable or very much valued animals, it most certainly would be. Of course, in many cases the ordinary and existing methods of management are adequate. But it is in those cases where this is not so that I submit that we should assume our professional responsibility, applying measures more humane than physical punishment, or more economical than the bullet. It is, however, not only therapy that should engage our attention. The causation and prevention of the animal-psychopathies is, of course, the proper line of approach.

I have heard it stated on the authority of one who is probably the leading neurologist of this century that the crying requirement in human psychiatry is more attention to comparative psychology; that if the medical psychologist would only pay more attention to the objective facts of animal psychology and behaviour he would be likely not only to acquire less respect for the theoretical concepts of Freud, but be in a better way to effect cures.

But it is the extraordinary fact that there is in this "animal loving" country no institute or even department of any institute that is practically concerned with the study of animal psychology or the problem of "the psychologically aberrant case." To the best of my knowledge no single worker in this country is concerned with the study of conditioning and the conditioned reflexes, with their enormous implications, although it is assuredly on these lines that the treatment of most cases rests. Indeed, it is my information that the Egyptian Government recently sent to this country a selected veterinary graduate for special training in comparative psychology who had, in the absence of any centre here for training in this field, perforce to proceed to America. Surely this is a shocking and disgraceful state of affairs!

In pathology, in bacteriology, in immunology and in certain other fields, this profession has more than held its own with the medical profession and other scientific circles; indeed, not infrequently "giving the lead over the fence." I submit with Miss Joshua that the time is long overdue when we should take up the cudgels professionally in respect of comparative psychology and the psychopathology of animals, before these matters are taken up by others less competent and with certainly less entitlement, and the opportunities still existing become lost to us.

Yours faithfully,

E. O. LONGLEY.

BLOOD TRANSFUSION IN PRACTICE

Sir,—In venturing to add something from the ecological angle to what my former Tasmanian colleague, Mr. J. Cassells, says in *The Veterinary Record* of September 10th about the treatment of parturient haemoglobinuria by blood transfusion, I do not intend to challenge Mr. Cassells' conclusions. On the contrary, on theoretical grounds his contentions seem to me unassailable, and it is my experience also that blood transfusions sometimes appeared to be of service in a critical case. For lack of time and facilities for controlled experiments, however, I was not able to evaluate my results, and I do not know how Mr. Cassells could evaluate his.

Parturient haemoglobinuria in Tasmania is extremely common and varies greatly in incidence and severity in different parts of the island. In one large dairying district in which I worked for over four years I estimated the percentage mortality from this disease at less than 20; in another district, which included a cold inland valley between mountains, where the main winter succulent crop was turnips, the mortality might have been as high as 30 per cent., or higher. But on the whole spontaneous rapid recovery was the rule and death the relatively small exception.

In the course of an investigation into the local incidence of acetonaemia in newly calved cows, I found many cases of fleeting parturient haemoglobinuria which had not been noticed by the owners. In one area, comprising about a dozen dairy farms, several cases were observed on most of the farms in one season, and only one cow died. Transfusion in this instance would have been a waste of time. The great difficulty thus was to find critical cases in which without blood transfusion death might be expected, but which yet were not so far gone as to make any therapeutic means useless.

My experience generally was that, whether transfused or not, if the cow was still standing, and would readily masticate sliced potato placed in the mouth, she recovered, but that if the cow was down and refused to masticate, she died.

On arrival at a farm in the above-mentioned valley between the mountains I found three cows, each of which had given a bucket of milk the previous day, down and in distress with the fulminating type of parturient haemoglobinuria peculiar to the locality. The least distressed cow of the three was given a blood transfusion; the other two were left alone. All three cows died that night. On another farm in the same locality, a cow which was down, but had survived for 48 hours, died from heart-block or shock while receiving the second litre of blood. I think this cow might have recovered if left alone.

A point worth remembering when handling cases of parturient haemoglobinuria for any purpose is the need for gentleness. The heart is working under heavy stress and any forcible restraint or hurried driving may be fatal. In one instance a cow, caught out in the paddock for examination, broke away from the owner's hold, galloped a few yards, and fell dead.

Regarding Mr. Cassells' observation that critical cases receiving two and a half litres of blood showed a "marked response in 24 hours with ultimate recovery," I feel bound to record that I often had the same experience with daily massive doses of molasses and bonemeal. Sometimes, however, this treatment failed—just as, in my hands, in fulminating cases, blood transfusions failed.

In diseases where spontaneous rapid recovery is the rule, such as equine colic and foul-in-the-foot of cattle, it is easy to credit a form of treatment with greater value than it really has, and I feel that this applies to blood transfusion in the treatment of parturient haemoglobinuria. Autopsies made by me, whenever possible, went far to convince me that when a cow died from this disease, no therapeutic means applied at a necessarily advanced stage could have saved the animal. In my view the extent of necrotic degeneration of the liver and the complete breakdown of the blood made recovery impossible.

Much better than treatment was prevention. It was found that if a cow, at the third or subsequent calvings, was kept off succulent crops for 14 days after parturition she was fairly safe. One experienced farmer in a notoriously bad area found that his cows safely could be allowed on a succulent crop one day in four after calving, but I advised abstinence for 14 days after calving as the safest rule.

Controlled experiments to determine this point, as well as to assess the efficacy of blood transfusion, are overdue in Tasmania. Pending such experiments, I think judgment as to the value of blood transfusion should be withheld.

Yours faithfully,

J. W. Rainey.

c/o Standard Bank,
Harrismith, O.F.S.,
South Africa.

SCHEME FOR THE CONTROL OF CERTAIN DISEASES OF DAIRY CATTLE

Sir,—In the first place I must admit to having been under a misapprehension in regard to the meaning of the contents of the recent circular letter to Divisions. I took them to imply that a particular draft of a "contract" scheme would be up for discussion, whereas what was wanted at our local Branch meeting was the original views of members on schemes in general. There was little time for the accurate framing and submitting of motions on this very important subject, and I would like to beg the courtesy of your columns in making plain some general opinions which I hold.

Most members of the profession are not in favour of hard-and-fast contract schemes for veterinary services. When too much or too little work is carried out for the agreed remuneration there is room for dissatisfaction in both cases. Yet both the livestock owner and the Ministry of Agriculture are bound to be interested in any kind of undertaking likely to be helpful to agriculture and the nation. From time to time it may be possible for the Ministry of Agriculture to help and encourage the control of a particular disease through a well planned scheme. Few would deny the benefits which have reached agriculture through the agency of the Attested Herds and Calf Vaccination schemes.

The Ministry must also be vitally interested in another object—the maintenance and development of clinical veterinary services throughout the country. These services are so varied in type and depend so much on individual effort that it seems impossible that they could ever be nationalised successfully. Yet they are vitally important in the development of a progressive and intensive livestock industry, which in the future may well be essential for this country. I was not surprised to hear from a Danish veterinary surgeon that in his part of Denmark there were two cattle to the acre and a veterinary practitioner every three to five miles. It simply shows what is necessary under given circumstances.

Fortunately there is no reason why the institution of well planned and practical Government schemes for control of particular animal diseases should not function alongside the maintenance and healthy development of clinical veterinary services. The work involved in such schemes is exactly the kind of work which practitioners have advocated and carried out among their progressive clients; it is straightforward in type and easily accomplished, though nevertheless a very necessary service. Such work has always proved a remunerative part of veterinary practice and the experienced practitioner well knows that it is required to balance the more difficult and unremunerative duties carried out at all times of the day and night and under a great variety of difficult and adverse conditions.

The Animal Health Division has in my opinion and experience maintained a sensible policy in the encouragement of disease control. Its schemes have been practical and well administered, while the veterinary practitioner has been able to participate freely in the work. I can write only from a practitioner's viewpoint, but sucessful development of disease control seems assured when carefully administered on these natural lines.

Yours faithfully,

Thornhill, Dumfriesshire. A. J. Kennedy.

October 27th, 1949.

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Sir,—Regarding the circular on a Scheme for the Control of Certain Diseases of Dairy Cattle, etc., undoubtedly the dairy farmer is wanting a scheme and one ought to be arranged for him, but it should include all the work on the farm—the cattle, pigs, horses, sheep, etc., and I should like it to include even the turkeys—but no other farmer wants a scheme. The sheep farmer and the arable farmer must be left out of it, as they have no desire for such a contract, also it would be most difficult to arrange one for them. Concentrate on the dairy farmer and leave the others alone, then something could be done.

Regarding vaccines, I think it is time the Ministry took more interest in their manufacture and either made the principal ones themselves or at least had a means of controlling them. During this summer I have lost four beef cattle from blackleg, all of which had been inoculated against it in the spring: three on one farm out of a batch of about 30 cattle. My opinion is that if they had not been inoculated the farmer would not have lost any more.

Yours faithfully,

Eastwick House, Evesham, Worcs. G. C. Lancaster.

October 30th, 1949.